ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

Birmingham, Salt Lake City, San Francisco and Cincinnati are some of the larger cities that have said "no" to municipal ownership in recent elections. Camden and Akron have said "yes." The over-all results are very encouraging and point out again that municipal ownership consists of much talk and little action. Increased taxes, political administration and satisfaction with present service are the elements that citizens weigh before voting.

●

All is quiet along the electrical code front. The N.E.M.A. code is still in the midst of practical application. The contractor code is not approved yet and is tied up with the construction industry code situation. The light and power code rests very quiet in the files. If government is going to put all industry groups under code by January first there must be fast action by industry and by government.

●

The latest is the plan of the new Civil Works Administration to put 4,000,000 men to work in the next thirty days. We wonder what would happen if these men devoted their efforts to a national plan for selling something—say the domestic market—instead of dredging creeks, landscaping parks and burning fallen leaves. We have an idea that the money spent on self-liquidating marketing projects would do more to bring back recovery than paying out a dole under the old scheme of using the woodpile to save our face.

●

We are astonished. More new ideas, suggestions and actual new devices and equipment have come to us in connection with our January 6 issue than we believed existed. The "bombs" of the engineers are going to be very disturbing to the status quo and will kick over present defensive works. Next year is going to be very interesting—a battle between technology and existing investment.

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NOVEMBER 18, 1933

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VOLUME 102 . . . NUMBER 21

Arc-Arrester Unit Hastens Extinction at Contacts . . . 652
By G. C. ARMSTRONG,
Westinghouse Electric & Manufacturing Company

Two-Phase Riser Loads on Three-Phase, Four-Wire Secondary Network 656
By LESLIE J. WEED, Edison Electric Illuminating Company of Boston

Sales—More Volume and More Profit 659
By L. W. W. MORROW, Editor "Electrical World"

Rent Ranges to Increase Usage 664

The Inspector Looks at the Contractor 666
By GEO. WELMAN, Louisiana Rating and Fire Prevention Bureau

Controlled-Atmosphere Electric Furnace Bright Anneals Tubing 668

Tap-Changing Transformer Used as Phase Shifter and Voltage Regulator 655
Gas-Filled Cable Tested in England 657
Fifteen Electric Booster Pumps on Great Lakes Pipe Line 658
Portable Equipment Insures Oil Well Pumping Efficiency 662
Oscillator Kills Grain Weevils in Few Seconds . 667
Direct Current for Long-Distance Transmission 669
Readers' Forum 670
Book Reviews 670
Men of the Industry 671

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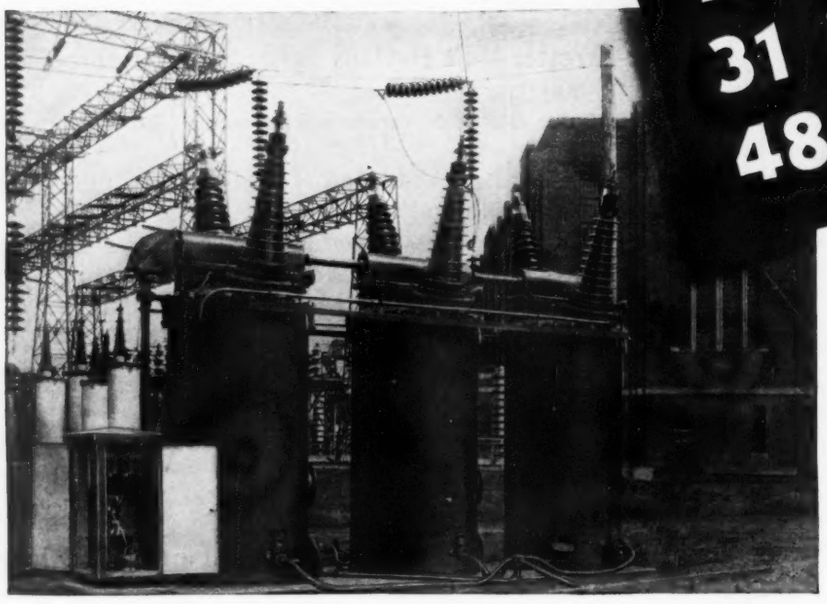
Another Company Modernizes Breakers with OIL BLAST

—94 in 3 years—



Type FHKO-139 breaker modernized with oil blast

Performance Counts. This is again evidenced by the fact that one of the large power companies has modernized an increasing number of breakers since 1931. During the last three years, 94 "FHK" outdoor-type G-E breakers, of various voltages, have been modernized and improved by the addition of oil blast.

The engineers of that company have found that oil blast assures better performance and higher speed of circuit interruption. Each year the success of these modernized breakers added further evidence of the effectiveness of oil blast.

You, too, can modernize your G-E breakers —quickly, easily, and economically. The addition of oil blast will result in greater interrupting ability; decreased maintenance; greater security; better service; and the rapid clearing of faults, which is one of the important factors in stabilizing a system.

Send for detailed information which will explain how you can modernize the G-E breakers on your system. General Electric, Schenectady, N. Y.

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GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

November 18, 1933

L. W. W. MORROW, *Editor*

What of the contractor?

IN THE beginning of the electrical industry there were no electrical contractors. Then, as the industry grew to larger estate, the contractor came upon the scene because he had a necessary part to play in the unfolding drama. Is the contractor coming now to the end of his part on the electrical stage? Is he to move over to another cast of players, the construction industry, and his voice be heard no more among his brethren?

Except in one respect the answer to this question is unimportant. Actually the electrical contractor does belong in the construction industry as much as does the carpenter, mason, plasterer, plumber or any other building contractor. So far as the performance of his work is concerned the electrical contractor is a construction man, a member of the building trades group. For some years past the electrical contractor has been becoming more and more identified with this group; he has assumed its manners of thinking. And of late he has been dismayed; frequently he has been troublesome, as the result of his attempt to think and act as a building tradesman among an industrial group that is painfully learning to think and act as salesmen and merchandisers.

It is no reflection on the building trades to say that its members wait for business to come to them. It is in the nature of things for this to be so. Oh, yes, there are plenty of wideawake business men in the building trades, just as good business men as in any other line, but the jobs they go after are the jobs that some one else offers for them to bid on. They are tradesmen, not salesmen.

The electrical industry is slowly changing its character, too slowly for its best good, but doing so nevertheless, from that of single concern with physical construction into that of promotion and selling. While other groups in the industry have been revising their attitudes and their viewpoints in conformity with the new dispensation, the contractor, possibly because he always has been more definitely a building tradesman and also because as a group he has never been adequately organized, sticks to the old gods and refuses, except in some conspicuously outstanding individual instances, to worship at the shrine of the new.

In ELECTRICAL WORLD for October 21, 1933, was published an abstract of the address of L. E. Mayer, president National Electrical Contractors Association, to the recent convention of the International Association of Electrical Inspectors. In this address Mr. Mayer presented adequately and clearly the viewpoint of the electrical contractor *as a tradesman*. But of the contractor as a business man, laying plans to develop and sell a market, Mr. Mayer said nothing at all. The contractors set their faces against any tampering with the National Electrical Safety Code; they want it more specific, more concrete, more definite, more detailed. They favor reinspection as a means to force improvement of existing wiring installations. They approve contractor licensing. They encourage, in the abstract, new developments in wiring methods and materials, but they reserve the right to pass their own judgment on any particular method or material. Let us grant that these are all good things just for the sake of avoiding argument on them in the present dis-

cussion. The point to be made from their citation is that they disclose the contractor alert and vigilant to protect and consolidate his trade; they do not show the contractor as alive and enterprising to promote and enlarge his business.

Mr. Mayer's address was extemporaneously discussed by George Welman, electrical engineer Louisiana Rating and Fire Prevention Bureau. ELECTRICAL WORLD asked Mr. Welman to put the substance of his remarks into an article for publication and it appears in this issue. Mr. Welman sees the contractor disappearing from the electrical industry if he does not make use of his opportunities as a member of it to promote its commercial development.

Motors deserve their meters

Things do not always go smoothly in even the well-regulated industrial plant. Occasionally a motor will kick up or fuses and breakers will blow mysteriously. Production will be interrupted by these causes or by perversity on the part of production machines themselves. Many times these interferences with smooth flow of the product through the plant will point to an electrical test of some sort to get at the facts and at the root of the delay. Speed is invariably demanded in getting the wheels turning again.

Many have been the instances where no meters whatever were available at the industrial plant, the electrical contractor in town had none and the nearest university laboratory where they could be borrowed was further away than the district headquarters of the power company or the service-maintenance agency. Some industrial plants are reasonably well fortified in this respect, but altogether too many are at the mercy of breakdowns and delays. Meters and the accessories that give them extended range are not costly, especially in the convenient portables of moderate accuracy that suffice for much of such emergency testing. Pennywise establishments would do well at their next upset to estimate the cost incurred while waiting for borrowed meters to arrive. It would be a fair bet that what would have been saved by having the test facilities at hand in one single instance would have paid the cost of the meters.

Then having learned the virtue of having metering and testing facilities at hand, it would be only a short step to decide where a permanent installation of graphic meters would not only give the answer to the immediate question but also provide a record that would have obviated the delay entirely by disclosing the antecedent conditions that led up to it.

T.V.A. to electrify through sales

In his Atlanta address David E. Lilienthal announced a new and constructive policy for T.V.A. He admitted there already existed excess private utility generating capacity and stated that the government projects would merely add more, unless people used more electricity. Thus the problem for private utilities and for the government is the same—more sales.

It will be interesting to see T.V.A. become a salesman—more particularly an appliance salesman. For many years the electrical industry has tried to sell. It has found that low rates alone will not sell. It has found that every method used to sell appliances is expensive and slow in accomplishment. Despite the expert sales and business talent available the domestic market has resisted sales efforts except under special conditions.

Now T.V.A. will try to do this sales task quickly. It has plenty of money; it has no inhibitions; it is ambitious and it can secure the cooperation of the entire electrical industry in a logical sales program. We can say very frankly that it will make slow progress if it uses the ordinary distribution methods and high-pressure specialty selling. It must use new methods and new ideas. Possibly one step is to put all electrical appliances and services in about 10,000 homes free of cost in two or three sections and convert the people through trial use. Possibly other new and radical methods can be used. The important point, however, is that T.V.A. realizes that the problem is one of sales and not a building problem. We hope that it tries out selling and gets at least a sample of an electrified America before it continues to build excess generating capacity. For it is possible that T.V.A. will be no better as a salesman than the electrical industry has been, in which case years must elapse before returns can be had on the taxpayers' money used by the T.V.A.

THE WEEK

Tupelo Contract Sets T.V.A. Standard

"THE 20-YEAR agreement between the T.V.A. and Tupelo, Miss. (the first municipality to contract for T.V.A. power) is expected to set a standard for contracts with other municipalities within transmission distance of Muscle Shoals," announces the Tennessee Valley Authority. "The Tupelo contract carries with it certain rules and regulations applicable to all T.V.A. customers." Tupelo agrees:

(a) To administer its electric system as a separate department and not to mingle funds or accounts with those of any other of its operations.

(b) To keep its electric system accounts according to a system of accounts to be prescribed by Authority after conference with Contractor, which system of accounts will so far as possible be uniform with other systems prescribed and applied in other municipalities purchasing electrical energy from Authority. Authority agrees at its own expense to render advisory accounting service in the setting up and administering of such accounts.

(c) To furnish promptly to Authority such operating and financial statements relating to electric system operations as may be requested by Authority.

(d) To allow the duly authorized agents of Authority to have free access to all books and records relating to electric system operations.

(e) To sell and distribute electrical energy to the ultimate consumer without discrimination between consumers of the same class, and no rate shall be charged or practice adopted which will grant a discriminatory rate, rebate or other special concession to any consumer served by Contractor. Contractor shall observe the principle that the sale of energy for industrial use shall be a secondary purpose, to be utilized principally to secure a sufficient high load factor and revenue to permit domestic and rural use at the lowest possible rates and in such manner as to encourage increased domestic and rural use of electricity.

The schedule further provides:

Lower Rates to other Municipalities—If at any time during the term of this agreement Authority should supply electricity to any municipality at a lower rate than that applicable to Contractor, and such lower rate shall not be justified by different conditions of service, making the cost to such other municipality relatively less than to Contractor, such lower rate shall be made available to Contractor.

Developmental Surcharge — Contractor agrees not to depart from the resale rates set forth in Schedule B (resale rates) without first securing the consent of Authority: Provided, however, that in order to maintain Contractor's revenues in the developmental period in which the increased demand for power may not compensate for the greatly reduced rates provided for in Schedule B, Contractor may impose a surcharge upon those classes of consumers subject to a surcharge under the provisions of said schedule. Contractor may initially determine and may from time to time vary such surcharge, with the understanding, however, that all revenues over those required for the appropriations set forth in Section 10 (a) herein shall be applied to the reduction or elimination of surcharges. Surcharges shall be based on a straight percentage of net bills, and shall apply uniformly to all members of classes as to which surcharges are authorized.

Adjustment of Rates—Should the cost of living index compiled by the Department of Labor show a decrease for six consecutive calendar months of 20 per cent or more under the index figures for the month in which this contract is signed, Contractor may in writing request Authority to agree to such a reduction in rates as the circumstances may warrant, and should such index figures show a 20 per cent or more increase for the same period, Authority may in writing request Contractor to agree to such an increase in rates as the circumstances may warrant. If within thirty days after the receipt of such a request the parties shall be unable to agree to a satisfactory adjustment, the question shall be submitted to three arbitrators, one to be appointed by each of the parties, and a third to be appointed by the two so selected. A decision of the arbitrators shall require only a majority vote, and such a decision shall be final and binding upon both parties.

Disposition of Contractor's Revenues—Contractor agrees to dispose of revenues from the operation of its municipal electric system in the following manner: (a) Revenues will first be used for operating expenses, after which, in the order named, revenues shall be made applicable to interest on electric system bonds and/or other indebtedness applicable to said electric system, amortization of such bonds, or other indebtedness, reasonable reserves for new construction and other contingencies, payment to the general fund of Contractor for taxes at rates equivalent to the taxes assessed against other property of a similar nature, and a return on Contractor's equity of not more than six per cent per annum. (b) After the appropriation of the above amounts the Contractor agrees that all of the remaining revenue shall be applied to reductions in the rates to consumers.

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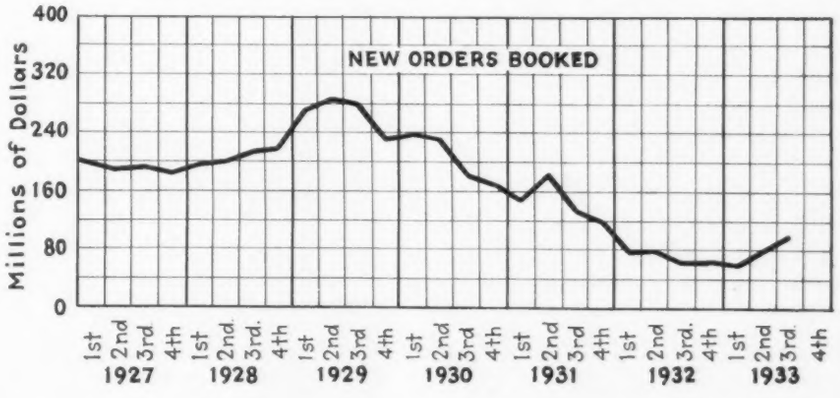
Electrical Manufacturing Gains Continue



At approximately the rate of improvement shown in the second quarter this year electrical manufacturing activity as reflected in new orders booked continues on the upgrade. New orders booked in the third quarter as reported to the Bureau of the Census by 78 manufacturers of electrical goods were $98,608,709, as compared with $79,856,484 for the second quarter of 1933 and $63,319,307 for the third quarter of 1932. The total includes motors, storage batteries, domestic appliances and industrial equipment, and while not representing a complete statement of the industry is considered sufficiently representative to indicate the trend in electrical manufacturng.

Detroit's 1,000-Deg. Turbine Completes 11,000 Hours

Reporting upon the results of operations with the British Thomson-Houston 1,000 deg. F. steam temperature turbine of the Detroit Edison Company, R. M. Van Duzer, Jr., has pointed to total operating hours of 11,231 since mid-1931, of which 7,832 have been at 1,000 deg. F.

To date the only large items of expense attributable to the use of high-pressure steam have been superheater repairs and the replacement of the throttle-valve body. Extensive tests have demonstrated the cost of oil for the superheater to reduce economies indicated solely by comparative heat consumption rates. The turbine is used normally at 30 per cent load, but for the application of full load for one hour daily.

▼

Oil Circuit Breakers Gas-Operated Now

Oil circuit breakers whose contacts are brought to the closed position by means of gas pressure rather than through the means of solenoids, motors, or hand operation are being introduced in Great Britain by Ferguson, Pailin, Ltd. Alleged advantages are the elimination in small installations of battery and auxiliary devices to supply motor or solenoid energizing current, low operating costs and positive closing under short-circuit conditions before reopening.

Essentially, the closing element consists of a cone-shaped vessel of thin metal containing a small quantity of material which gasifies at a temperature of about 300 deg. C. A heater strip or wire passes from one side of this vessel to a lightly insulated pin. The latter is connected to a dry cell through flexible lead and to a spring-loaded contact.

To close such a switch the current is passed through the heater, the temperature of which is instantaneously raised to 300 deg. C. so that the gas expands rapidly. A plunger is driven upward and the springs between the expansion chamber and the trip mechanism are compressed. After each stroke the closing element has to be renewed, a matter of what is said to be two minutes and small expense.

▼

Fish Clog Condensers

Considerable difficulty, in fact interruptions to service and therefrom to street railway transportation, has occurred recently in England through the choking of condenser tubes at the new station of the Swansea Corporation Electricity Committe by immense numbers of small eels, fish and crabs which passed through even the fine mesh protective screens installed. Poisoning of the water supply is being seriously considered.

▼

Divided Auxiliary Core for Squirrel-Cage Motors

Squirrel-cage motors with an auxiliary core, possessing the features of high specific starting torque, smooth and rapid acceleration or retardation, efficient inherent braking action, robust mechanical construction, simple control apparatus, low initial cost and low maintenance charges have been discussed by D. Dyson Rayner in a recent issue of the *Electrical Review* (England).

In the motors described the auxiliary core is divided into two parts, one member rotating with the rotor and the other fixed in the stator frame in a similar manner to the main core; this member is provided with a compensated winding. The resulting effect is said to be like that of a motor provided with two stators and two rotors on a common shaft, the actual proportion of the two units depending on the starting torque required. The compensating winding may be connected across a condenser system or through the starting switch to the source of supply.

The control equipment necessary consists of a direct-on starting switch (the condenser being permanently connected to the compensator winding) and two auxiliary switches. The motor rises to full speed under maximum starting torque and is then operated as an ordinary squirrel-cage machine. The starting condition is said to be equivalent to a starter with an infinite number of steps and to be independent of the skill of the operator and free from the susceptibilities of the various forms of accelerating control devices embodied in automatic starters. The time of starting is proportional to the load on the motor.

▼

High-Speed Turbines in France

Three 72,000-kva., 3,000-r.p.m. turbo-generators are being constructed by the Forges et Ateliers de Constructions Electriques de Jeumont, France, and the Ateliers de Constructions Electriques de Charleroi, Belgium, for the new St. Denis power station of the Société de l'Electricité de Paris. Electric welding is being used widely in the fabrication.

▼

Work Has Begun on Bonneville Dam

Brubacher Aerial Surveys

Forty miles up the Columbia River from Portland, Ore., at Bradford Island, shown in the illustration, will rise the Bonneville Dam, for which the Public Works Administration has allocated $20,500,000. This will be the first federal power project on the Columbia, although a tentative allocation of $63,000,000 and funds for preliminary work have been made to the Columbia Basin Commission for the Grand Coulee development. The dam is to be of the Ambursen type with an earthfill dike. An initial installation of 90,000 kw. is planned; an ultimate capacity of 540,000 kw. is said to be possible.

Insull Verdict Defended; Not Coming Back, He Says

Greek courts judged Samuel Insull justly and in accordance with clauses of the extradition treaty which the United States itself dictated, the government there has held in a stoutly uncompromising note replying to American denunciation of the pact.

It was impossible, the government said, for it to interfere with the course of justice and extradite Insull at the United States' behest. "Apparently," the note said, "the United States would be appeased only by Insull's extradition."

Samuel Insull, interviewed in Athens, has been reported to have said in response to inquiries:

"If you were 74 and in my position, would you go back to the United States when your life would be in danger from being cut off any moment?

"Even though I would stand a mighty good chance of acquittal, I would not consider returning. The United States has not shown me any consideration. It has hunted me like a criminal these past two years. They want a victim, but I am too much of a prize to be taken back so easily."

▼

Utilities and Employees Consider Unionization

More than 15,000 employees of all departments of the New York Edison and the United Electric Light & Power companies will have an opportunity November 22 to express their opinion whether there should be adopted and put in force a plan of organization for collective bargaining as to wages, hours and conditions of employment through representatives elected by the employees. The two companies have announced that the "voting will be under the usual safeguards of secret ballots, sealed ballot boxes and supervision of a representative board of tellers selected from the rank and file of the workers."

This plan for collective bargaining between the representatives of the companies and of the employees has been prepared by officers of the companies in consultation with workers from various departments. No officer of the companies, no department head and no employee working in a supervisory capacity will be permitted to take part or to vote in this election, or to coerce or interfere with the exercise of a free voice by any employee, it is announced.

Boston Edison adopts plan

Last week the executive committee of the Boston Edison board accepted an employee representation plan for collective bargaining which bore the approval of 87 per cent of the employees voting on the proposal a few days before. The plan provides a practical medium for interchange of employee ideas and an unbiased proving ground from which the management will receive representative employee opinion on any matter within the unrestricted scope of the organization's discussion. The organization by-laws designate Herbert W. Moses, head of the employment bureau, as chairman, without vote, of the organization council, which will hold monthly meetings. About 3,000 of the company's 3,200 employees are included in the plan of representation, the remainder being officials or staff members of relatively higher rank.

Headquarters for a newly organized utility workers' union in northwestern Indiana has been established at Gary, Ind. The organization is said to consist of about 450 employees of the Northern Indiana Public Service Company. The Indiana group is alleged to be affiliated with a similar group in Chicago.

▼

Perhaps It Is Later Than You Think

Retailing establishments in all parts of the country, notably chain and department stores, report remarkable improvement in sales following election day and in direct response to lower prices. Retail prices have undergone a general recession because of large inventories and a concerted desire that the latter be reduced. Lighting fixture sales, say manufacturers and retailers, are at the highest levels since the depression started. Treasury Department in informal ruling offers assurances that, because of repeal, three of four special taxes (½ cent on gas, 5 per cent on dividends and excess profits tax) will go January 1; the capital stock tax on July 1. Bituminous coal and steel outputs hold level. Electrical energy production rallies toward 1931 levels in a sharp upswing.

After that one must look far into the post-election gloom for comfort and solace. Under the combined wrecking efforts of the government and self-preservation instincts of scared capital-owners the dollar has sunk to new lows. Bond markets slump wildly; stocks irresolutely await developments; speculative commodities rise somewhat. General business indexes drop to late April levels. Carloadings, in pre-election week, fell 4.5 per cent. Lumber output off. Automobile plants, preparing, with delays, to make 1934 models by December 1, drop output to below 1932 levels for first time in seven months.

No Pay for Humphrey

Contending that William E. Humphrey, Roosevelt-deposed Federal Trade Commissioner (ELECTRICAL WORLD, October 14, page 483) was properly removed by executive order, Controller-General McCarl has ordered that his salary be paid to George C. Matthews, his appointed successor. Mr. Humphrey plans to go to the Court of Claims in suit to attach the salary of Matthews on the ground that his removal was improper.

▼

New York Diesel Plants Yield to Purchased Power

Two Diesel-engine private generating plants, both about four years old, have recently been shut down in New York City and purchased power substituted. They are the Hotel Chelsea automatic installation, involving three 50-kw. units, and the Sigmund Ullman division of the General Printing Company, involving two 300-kva. units. The first is now being supplied by the United Light & Power Company and the second by the New York Edison Company.

The Chelsea installation, while installed in the hotel, was owned by C. F. Strong, inventor of the automatic system. However, inconveniences which the hotel suffered as a result of private-plant service, with the second-hand engines used, induced it to change to purchased power. The printing ink plant owned its private plant but likewise suffered inconveniences from interruptions so that it decided when its power requirements were increased to change to purchased power.

▼

Chicago World's Fair Closes

After entertaining nearly 22,300,000 persons who at the Fair Grounds expended $25,545,000 the Century of Progress exposition closed last Saturday. It is possible that a reopening will be held next June. The fair cost about $37,000,000 to stage. The Columbian Exposition of 1893 drew 21,480,141 persons and $10,000,000 more to present.

I am positive that we shall rediscover the impracticability of attempting to repeal by fiat laws of economics and of human relations which, after all, are but expressions of the natural psychological reactions of man to certain conditions.

C. F. HIRSHFELD
Chairman
Engineers' Council for
Professional Development.

Dr. Hirshfeld, who is also director of research for the Detroit Edison Company, told a meeting of the Society for the Promotion of Engineering Education this week that he ventured to predict a return "to essentially what we had before" and condemned the "economic juggling" of "politically actuated Congressmen and cloistered bureaucrats."

Coming Meetings

American Society of Mechanical Engineers—New York, N. Y., December 4-9. C. W. Rice, 29 West 39th St., New York.

American Physical Society — Annual meeting, Boston, Mass., December 28-30. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—New York, N.Y., January 23-26. H. H. Henline, 29 West 39th St., New York.

▼

Washington Acts in Law to Control Utility Budgets

Privately-owned utilities of Washington have been requested by that state's Department of Public Works to comply with a new law requiring them to file budgets of their expenditures in detail with the department. The new law also gives the department the "right and power of regulation, restriction and control over the budgets of expenditures of public service companies."

In placing the budget provisions of the new law into effect, the department directed the companies to file their budgets on or before November 15. To be shown was the amount of money which, in the judgment of the company, would be needed during 1934 for maintenance, operation and construction, classified by accounts as prescribed in new budget regulations. The new law applies to all gas, water, telephone, telegraph, electrical and toll bridge companies in the state whose annual gross operating revenues exceed $10,000.

Under the department's budget regulations, failure of the department to object to any item within 60 days from the filing of the original budget shall constitute authority to the company to proceed under the financial outlay submitted. Adjustments or additions may be made from time to time during the year by filing a supplementary budget for approval or rejection. Budgets filed by the companies must be divided into operating construction and betterment, and such other special budgets as the department may require. Budgets also must classify proposed wage scales as to type of service performed and show the basis and rate of payment.

▼

New Unit for Detroit

As previously reported, the Detroit Edison Company has been installing a 50,000-kw. turbo-generator in Delray power house No. 3. This machine went into service on October 20, 1933. Because of the partial reconstruction of the Connors Creek plant the total generating capacity of the company has recently been decreased by 20,000 kw., and will be decreased by another 20,000 kw. in December, 1933. Recent changes involved were described in the ELECTRICAL WORLD, October 28, page 570. Rebuilding of four units to produce two was the essential change.

▼

Broader Aspects of Power Pointed by Lilienthal

Frank recognition of some of the more fundamental and less political aspects of electric light and power enterprise than has recently been expressed by government representatives was voiced by David E. Lilienthal of the Tennessee Valley Authority in addressing an Atlanta audience late last week.

"The electric industry, both privately and publicly owned," said Mr. Lilienthal, "is running into a financial blind alley unless the use of electricity can be very substantially increased within

the next three years. The plain fact is that the use of electricity has fallen behind the installation of power-generating facilities. This is true, almost without exception, throughout the country.

"What power has done for us and what promise it holds we often fail to realize. It is in large measure due to electric power that for the first time in history we are equipped to produce enough commodities to supply the necessities and even many of the luxuries to most of our people. The future possibilities are limitless.

"I suggest a five-point program:

"1. We must begin thinking in terms of an electrified America, and cast aside the tradition which is binding us to our present niggardly use of electricity.

"2. Our entire electric rate structure must be re-examined and drastically revised.

"3. Electric-using appliances must be put into the homes and on the farms on a scale heretofore not successfully attempted.

"4. All the forces of business, scientific and engineering ingenuity and technique must be concentrated upon the problem of reducing certain of the costs of operation.

"5. The people of the country must be brought to realize that there is a pool of electricity lying idle, ready and waiting to be used, and to realize what electricity can do in lightening their burdens, in increasing their incomes and making for a richer and better life.

"There are difficulties in the way of effectuating a wide distribution, at low cost, of standardized high-quality electric appliances which the manufacturers of this country are producing," concluded Mr. Lilenthal. "These difficulties are by no means insuperable.

"While I am not at liberty to discuss the matter at this time, I would be less frank than I have a right to be if I did not say that a definite plan for this phase of the program is approaching completion, with the co-operation of many interests."

Norris Dam under way

Allegedly more than a month and a half ahead of schedule, construction work on the Norris Dam has begun. The first cofferdams are being installed for unwatering the bed of the Clinch River. As soon as these cofferdams have been completed the work will begin on the dam's foundations. Preliminary calculations had set January 1 as the date when this work would get under way.

During the past month the Tennessee Valley Authority has placed orders for equipment and supplies totaling approximately $1,500,000. These orders were placed with concerns located in various sections of the country and are providing employment in many distant centers. The authority is employing about 2,000 people, under a payroll of more than $150,000 per month.

Not only will the name of Senator Norris be remembered in connection with Norris Dam but a village under construction about 4 miles south and a little west of the dam is to be known as Norris.

The government is being placed in a position frequently encountered by private utilities through the action of Mayor Glenn of Florence, Ala. Mayor Glenn has announced that in the hope that lower energy rates than have heretofore been offered by T.V.A. may be obtained he is protesting T.V.A. schedules and applying to the Public Works Administrator for $400,000 with which to build a municipal plant to compete with Muscle Shoals power. The authority, the Mayor stated, wants Florence to make commercial and industrial customers compensate any loss on the residential customer. That, he said, "takes away the dream we have had of cheap power and as much of it as we wanted."

Federal Trade Commission investigators have been sent to Birmingham and Knoxville, it is reported, to determine

whether or not large expenditures had been made by private utilities to defeat T.V.A. power plans. It has been alleged that as much as $50,000 was spent to insure the defeat dealt to municipal ownership in the recent Birmingham election.

More P.W.A. loans granted

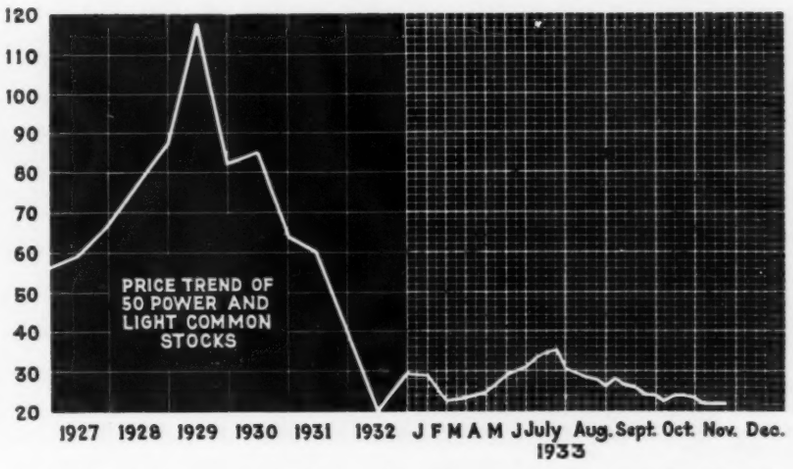
Additional loans and grants to municipalities for the construction of municipal electric light and power plants have been announced by the Public Works Administration. The application of Culpeper, Va., which has been in dispute as to whether power interests were hindering its approval (ELECTRICAL WORLD, November 11, page 619) has been approved by Secretary of the Interior Ickes. A grant to the city of $125,000 has been authorized, representing 30 per cent of the cost of building the proposed plant, and a loan of $45,000 additional.

Belmont, Mass., received a grant of $16,100 to aid in the construction of an extension to the existing electric substation. No loan was requested. The allotment represents 30 per cent of the cost of labor and material on a project of which the total cost is $63,450. The balance will be furnished by the applicant from other revenues.

Proposal for construction of a $3,000,000 power plant project on the Arkansas River near Kaw City, in Osage County, Okla., has been submitted to the State Department of Power, Waterways and Flood Control for consideration. Any approval of the plan would be transmitted to the federal government as a public works loan project. The Osage County delegation sponsoring the project informed the state department the plan calls for sale of electric power to cities and towns within an 80-mile radius of the proposed site.

Numerous committees along the Shenandoah River in Virginia are not taking kindly to efforts to revive a twenty-year-old plan for harnessing the Potomac and Shenandoah rivers at Harpers Ferry, W. Va., for electric power and lighting projects, with the federal government furnishing large sums to finance the project. Various municipalities, county authorities and private landowners from Harpers Ferry to Broadway, on the north branch of the Shenandoah River, in Rockingham County, Virginia, have voiced strenuous objection to such a project ever since the scope of the proposed enterprise was outlined some years ago, and they are now renewing these objections on the ground, and for the reasons originally advanced, that the construction of large impounding dams, as proposed, would have the effect of inundating large areas and thus virtually destroying the usefulness of agricultural tracts.

Little Change in Stock Prices



Along with the general market, light and power common stocks showed little change in price levels. The "Electrical World" average, last week 22.3, rose to 22.4. Trading volumes were small.

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Services of Harry S. Berry, public works engineer in Tennessee, were speedily terminated this week, after he had expressed a supposition in a circular letter that municipalities seeking loans from the Public Works Administration will not be forced to repay them. In dismissing Mr. Berry, Mr. Ickes stated as a general policy: "Loans by the federal Emergency Administration of Public Works are loans the government expects to be repaid. These loans are made under the law on legal security which is examined before contracts with the borrowing body are signed. . . ."

Dexter Cooper Corp., Inc., Eastport, Me., is planning a tidewater hydro-electric power development on the Bay of Fundy at North Eastport, Me., a gigantic project estimated to cost about $60,000,000. Dexter P. Cooper, president and chief engineer of the company, has outlined the project and is applying to the federal government for financial aid under the public works act of the NRA program.

An additional allotment of $9,500,000 for the Fort Peck Dam and reservoir project in eastern Montana has been approved by the Public Works Administration, bringing the total allocation for this project to $25,000,000.

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Foshay Convictions Stand, Appeals Court Rules

Conviction and sentencing of Wilbur B. Foshay and Henry H. Henley for using the mails to defraud has been upheld by the United States Circuit Court of Appeals in St. Louis.

Foshay and Henley, who founded the Foshay group of Minneapolis-centered properties which collapsed in November, 1929, with a loss of millions of dollars to investors, were sentenced to fifteen years' imprisonment some time ago.

The opinion, filed in federal court here, brushes aside every assignment of error made by Foshay and Henley and calls their operations "merely a dishonest stock-selling scheme."

Judge J. W. Woodrough wrote the opinion, which was concurred in by Judge Kimbrough Stone and Judge William J. S. Kenyon, deceased. Judge Kenyon voted to affirm the conviction, but died before the opinion was written.

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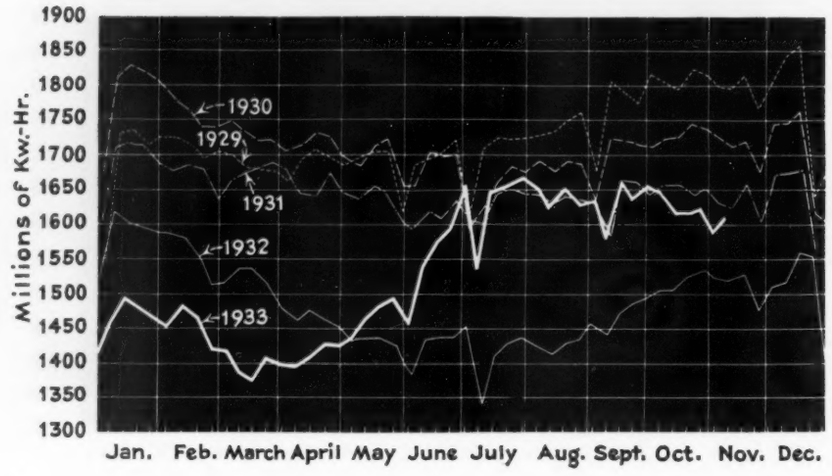
Stone & Webster Reduces Debt; Cash Rises

Reporting as of September 30, 1933, Stone & Webster, Inc., including subsidiaries, showed cash of $9,709,500, an increase of $1,808,500 over the $7,901,000 as of September 30, 1932.

The company states loans to have been reduced $4,703,500 from a year ago, and $2,473,500 during the nine months of this year, standing at $4,327,500 as of September 30, as compared with $9,031,000 on September 30, 1932, and $6,801,000 December 31, 1932.

An underlying bond issue of Puget Sound Power & Light Company, amounting to $1,924,000 due June 1, was paid off. About 60 per cent of the reduction in notes payable was accomplished through the sale around the year-end of bonds of Louisiana Steam Generating Corporation, a subsidiary of Engineers Public Service Company. Of the notes payable on September 30 this year $2,857,000 represented borrowings of the Puget Sound Power & Light Company.

Output Up Despite Election Day



Although the week ended November 11 included election day, the output of central stations rose more than 33,000,000 kw.-hr. to 1,616,875,000 kw.-hr., according to the Edison Electric Institute. The increase broadens the gain over 1932 to 6.3 per cent, the greatest in four weeks, and nearly restores the equality with 1931 that prevailed during August and September, the disparity being cut to 0.4 per cent.

Improvement was general except in the South. Recent gains in the Mountain states, already large, increased further, passing 30 per cent. In the Central industrial area the excess over 1932 approached 10 per cent. New England's 6.6 per cent is the largest since early October, as are also the Middle Atlantic and Pacific Coast gains.

Weekly Output, Millions of Kw.-Hr.

1933	1932	1931
Nov. 11... 1,617	Nov. 12... 1,521	Nov. 14... 1,623
Nov. 4... 1,583	Nov. 5... 1,525	Nov. 7... 1,628
Oct. 28... 1,622	Oct. 29... 1,533	Oct. 31... 1,652
Oct. 21... 1,619	Oct. 22... 1,528	Oct. 24... 1,647
Oct. 14... 1,619	Oct. 15... 1,508	Oct. 17... 1,656

Per Cent Change from Previous Year

Region	Week ended Nov. 11	Nov. 4	Oct. 28
New England	+ 6.6	+ 5.2	+ 4.8
Middle Atlantic	+ 5.1	+ 1.0	+ 4.2
Central Industrial	+ 9.9	+ 5.5	+ 8.2
West Central	+ 1.6	— 0.6	+ 0.5
Southern States	— 1.0	+ 0.8	+ 2.5
Rocky Mountain	+30.6	+29.2	+22.8
Pacific Coast	+ 2.6	— 0.8	+ 0.7
United States	+ 6.3	+ 3.8	+ 5.8

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September Output Rose by 9 per Cent, Says Survey

Confirming with more detailed statistics what had already been evident from the weekly survey by the Edison Electric Institute, the report of the U. S. Geological Survey on the September output of public utility power plants shows a decreasing margin of gain over 1932. The production of 7,344,000,000 kw.-hr. was 9 per cent greater than a year ago, while the excess in the preceding month was 14 per cent.

Compared with August there was a decrease of 340,000,000 kw.-hr. in aggregate output, equivalent to a decline of 1.2 per cent in average daily production, whereas the normal change is an increase of 2 per cent. The share contributed by water power remains unusually large; it amounted to 39.5 per cent in September.

In reviewing these various changes one important comparison should not be overlooked. Last year the output during September was 0.6 per cent less than during April. This year it was 13.6 per cent more than in April. The pronounced gains in the Mountain, South Atlantic and East North Central divisions of the country are evident from the following table:

Division	Per Cent Change from Previous Year August	September
New England	+24	+ 8
Middle Atlantic	+ 9	+ 3
East No. Central	+19	+14
West No. Central	+ 2	+ 8
South Atlantic	+25	+20
East So. Central	+13	+ 6
West So. Central	+ 5	+ 8
Mountain	+23	+25
Pacific	+ 8	+ 3
United States	+14	+ 9

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Complete Electrical Census Shows Five-Year Trend

Summarizing that series of statistics by states which has been published during the past few weeks in successive issues of ELECTRICAL WORLD, the Bureau of the Census announces corresponding totals for the country as a whole based on its canvass of the electric light and power industry for 1932. These are preliminary statistics, subject to revision.

While prime-mover capacity increased 34.3 per cent compared with 1927 and generator rating by almost the identical ratio, output was only 6.7 per cent greater because of the sharp reduction in 1932 from that of the two preceding years. The number of establishments, on the contrary, decreased greatly. Consolidations cut down the number of commercial establishments 23.9 per cent, and municipals show a net decrease of 18 per cent as a result of abandonments of plants and the acquisition of municipal generating and distribution systems by commercial undertakings. Growth in the average size of units is also evident.

Difficulty in allocating border-line cases seems to be about the only valid explanation for a considerable disparity between some of the Census figures for 1932 and those announced earlier in the year by the U. S. Geological Survey on the basis of its monthly returns. The latter gives the capacity of central stations as 34,010,137 kw., against the 34,624,068 kw. of the Census, and an output of 77,868,294,000 kw.-hr., against

Summary, Electric Light and Power Census, 1932 and 1927

Item	1932	1927	Per Cent of Incr. or Dec
Number of reporting establishments, total	3,429	4,335	—20.9
Commercial	1,627	2,137	—23.9
Municipal	1,802	2,198	—18.0
Number of establishments[1] reporting generating equipment[2]	1,867	2,431	—23.2
Number of plants reporting distribution only	1,628	2,004	—18.8
Prime movers:			
Total number	11,182	12,030	— 7.0
Total horsepower	47,965,990	35,710,128	34.3
Steam turbines:			
Number	2,821	2,864	— 1.5
Horsepower	32,904,258	24,323,304	35.3
Steam engines:			
Number	1,300	2,267	—42.7
Horsepower	648,501	994,273	—34.8
Internal-combustion engines:			
Number	3,276	3,177	3.1
Horsepower	866,312	548,288	58.0
Hydro-turbines:			
Number	3,785	3,722	1.7
Horsepower	13,546,919	9,844,263	37.6
Generators:			
Number	11,108	11,967	— 7.2
Kilowatt capacity	34,624,068	25,811,305	34.1
Output of stations (kilowatt-hours)	79,657,431,657	74,686,378,010	6.7

[1]Covers 4,350 generating stations for 1932 and 4,801 for 1927.
[2]Includes 66 establishments reporting idle generating equipment for 1932 and 100 for 1927.

79,657,431,657 kw.-hr. The discrepancy in large measure disappears if the Survey's figures for public works and for manufacturing plants contributing to the public supply are added in.

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Swiss High-Head Station to Develop 157,000 Kw.

Allegedly pre-empting all previous records for high-head hydro-electric stations, the new 157,000-kw. plant on the Dixence River in Switzerland offers an operating head of 5,740 ft. A special tunnel nearly 7 miles long and about 8 ft. in diameter will connect the storage reservoir with the penstocks. The latter will lead the water to the turbines driving five generators having each an output of 37,500 kva. at 13,000 volts and 500 r.p.m. Three turbo-generator units will be installed at present. An auxiliary generator having an output of 7,000 kva. at 10,000 volts will supply electric energy to the control system of the power station and to a few villages situated in the neighborhood. The electric current will be transmitted to the general distribution system through overhead lines operating at 66 kv. and 132 kv.

The power station will be used only during six months every year, mainly in winter, the balance of the time allowing to store the necessary quantity of water.

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New York Metal Prices

	Nov. 6, 1933 Cents per Pound	Nov. 14, 1933 Cents per Pound
Copper, electrolytic	8.00	8.25
Lead, Am. S. & R. price	4.30	4.30
Antimony	6.70	7.20
Nickel ingot	35.00	35.00
Zinc, spot	4.87	4.85
Tin, Straits	49.75	53.90
Aluminum, 99 per cent.	23.30	23.30

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Austin Dam Delayed

Austin Dam, Inc., a subsidiary of Electric Bond & Share Company, has requested the Austin, Tex., city commission to grant a two-year extension from November 28, 1933, for starting the work of rehabilitating the dam across the Colorado River and the hydro-electric plant here. In the meantime the company will clear the lake bed of accumulated débris. The estimated cost of restoring the concrete dam is $400,000, which A. S. Grenier, president of the company, would be unable to secure at this time. The city would receive delivery of 4,000,000 kw.-hr. of power beginning November 29, 1933, as originally proposed. Austin Dam, Inc., under the contract approved December 1, 1931, by the federal court at San Antonio, was given a lease of 40 years by the city of Austin to operate the dam after its rehabilitation November 28, 1933.

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Westinghouse Elevators

Westinghouse Electric Elevator Company, subsidiary of Westinghouse Electric & Manufacturing Company, has purchased the elevator business of the Consolidated Steel Corporation of Los Angeles.

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Brockway Builds Electrics

Announcement has been made by the Brockway Motor Company, builder of gasoline-propelled vehicles since 1912, of its entrance into the electric truck field with several battery-driven models.

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Lynn Voltage Raised

During the period of 1927 to date the Lynn Gas & Electric Company has raised its standard distribution voltage from 110 to 120 in two major steps. Shortly before the voltage increase began the company sent letters to all lamp dealers and electrical contractors regularly supplying its territory, requesting that at the beginning of the following month only 120-volt lamps be sold in that area. On the first day of the month after the notification the voltage was raised by 1 and on the first day of each of the five following months the same increase in potential was effected until the final value of 120 volts was reached. Aside from notifying contractors, dealers and manufacturers of lamps ahead of the voltage change, the company did not inform its customers of its program, but within a few days after the 120-volt level had been reached a newspaper statement was published pointing out what had been done and citing the paucity of complaints.

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Major New Construction This Week

Montana Power Company plans transmission line to Fort Peck, about 20 miles from Glasgow, Mont., for government service for new dam and reservoir on Missouri River.

State Board of Control, Madison, Wis., plans power plant at Northern Wisconsin Training School, Chippewa Falls. Cost $240,000, with equipment.

Hartford Pure Rye Distillers, Inc., Havre de Grace, Md., recently organized, plans plant of 1,000,000 gal. annual capacity. Cost about $100,000.

Appalachian Electric Power Company, Roanoke, Va., plans new transmission line in vicinity of Woodson, Va.

Lamoni, Iowa, plans city-owned electric light and power plant. Cost $100,000, with distributing system.

A 2,500-kw. turbo-generator unit, with complete accessories, will be installed at power plant of Chambersburg, Pa. Fund has been secured.

Otter Tail Power Company, Fergus Falls, Minn., plans new transmission line in vicinity of York and Hong, N. D. Permission granted.

Kenilworth Brewing Company, Washington, D. C., recently organized, will build $100,000 plant.

Plans have been authorized by State Department of Correction, Boston, Mass., for new electric generating plant at State Farm, Bridgewater, Mass. Cost over $100,000. Boston State Hospital to make $350,000 addition to its power house.

Until November 20, Plainview, Tex., asks bids for three Diesel engine-generator units and complete accessories for city-owned power plant. Also for distributing system, requiring about 2,000 poles. Fund of $423,000 available.

Marquette Brewing Company, Peoria, Ill., plans new multi-unit plant. Cost over $150,000.

Blue Earth, Minn., asks bids until November 24 for turbo-generator unit with accessories. Appropriation of $90,000 arranged.

Wisconsin Veterans' Home, Waupaca, Wis., plans new power plant at cost of about $200,000.

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Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	October 1932	October 1933	Per Cent Inc. or Dec.	Ten Months 1932	Ten Months 1933	Per Cent Inc. or Dec.
New York	174	134	−23.0	2,363	1,441	−39.0
Middle and Southern Atlantic	89	57	−36.0	1,053	530	−49.7
New England	82	45	−45.1	992	552	−44.3
Central	335	212	−36.7	4,476	2,459	−45.0
Total	680	448	−34.1	8,884	4,982	−43.9

Total Amounts Reported

New York	$15,488	$8,352	−45.9	$212,051	$96,638	−54.4
Middle and Southern Atlantic	5,096	5,321	+ 2.6	92,250	33,367	−63.8
New England	7,473	2,953	−60.4	78,777	32,442	−58.8
Central	20,088	9,961	−50.4	313,624	140,734	−55.1
Total	$48,105	$26,497	−44.9	$696,702	$303,181	−56.5

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Electric Fountain for Caracas

An illuminated, return-circulation electric fountain has been installed in the center of the Plaza Nueva Circo in Caracas, Venezuela. Venezuelan national colors, blue, red and yellow, and changing water displays follow a regular cycle, lasting twenty-one minutes. Westinghouse engineers devised the display.

As to Rates——

• Georgia Power Company's rate case opened last week before the new Public Service Commission with a request that the company prepare data which will divulge all transactions from 1926 up to date. These sweeping demands call for an analysis of all work done since 1926 and the interest which was capitalized, list of the stocks canceled and exchanged in the mergers perfected in September and November, 1928, copies of contracts between the Georgia Power Company and the Southeastern Securities Company and a history of the transfer of the Georgia Power & Light Company to the Southeastern Securities Company and the valuations of the Georgia Railway & Power Company as carried on the books of the Southeastern Securities Company and the Southeastern Power & Light Company. The commission is also asking that an analysis of the retirement reserve and detailed statement of operating income from 1927 to date be prepared, also the history of the surplus account. The new commission is also going to investigate all contracts for service charges by affiliated companies for managerial, engineering and other services. The effects of past rate reductions will also be investigated.

The commission refused to pass on rates of the company, on the basis of evidence in former hearings, and allowed the company until November 20 to prepare a new case in support of its tariffs. John T. Goree, Assistant Attorney-General and counsel for the commission, expressed surprise that some at least of the information requested of the company was not available for immediate discussion, but acquiesed in the recess, saying he did not wish to work a hardship on the power company by insisting on immediate delivery.

• Memphis Power & Light Company has voluntarily offered to enter negotiations with the city looking toward a reduction in electric rates as an emergency sacrifice made in an attempt to help restore business conditions. Mayor Watkins Overton said the city would enter the negotiations, but that the city's application to the Tennessee Valley Authority for Muscle Shoals power would not be affected in any way. The company's letter stated that although the company was earning less than its allowed return and faced increasing costs, it realized that the depression is not over and that it should make whatever sacrifice is possible in order to aid business recovery.

• Laclede Power & Light Company of St. Louis, Mo., has voluntarily filed with the Missouri Public Service Commission at Jefferson City a new schedule of rates for electricity which is approximately 10 per cent below the charges for residential and commercial use made by the rival Union Electric Light & Power Company. The Laclede company claims that its new rates are the lowest in the United States. If approved the new rates will provide: First 25 kw.-hr. a month, 4½ cents per kilowatt-hour; for next 150 kw.-hr., 2½ cents, and for all in excess of 175 kw.-hr., 1½ cents. The Laclede Company has about 15,000 residential and 5,000 commercial customers. The company officials estimate the new rates will save their customers $115,000 a year.

• Officials of fourteen Indiana towns have petitioned the Indiana Public Service Commission for reduced electric rates. Each operates its own distribution system, but purchases electrical energy from the Public Service Company of Indiana and the Northern Indiana Power Company. The principal objection to present rates was that the "demand charge" made by the company is based upon a short period of heavy electrical usage and it is unfair. A reduction in the demand charge as well as a cut in the price per kilowatt-hour is asked. A unification of the prices for all towns which are of approximate equal size is asked. Present hour charges range from 2.130 to 3.369 cents a kilowatt-hour.

• Public Service Electric & Gas Company executives' salaries were listed in answers filed with the Board of Public Utility Commissioners by the company in compliance with the commission's ruling that it must furnish information sought by petitioners seeking a reduction in electric rates. The principal officers also are officers of the Public Service Corporation, the parent company and of operating subsidiaries. The information supplied was on salaries from the electric and gas company alone. There was no reference to salaries from the other companies. Thomas N. McCarter, president, received a salary of $72,750 in 1932. His salary was cut to $50,000 effective October 1 this year. Percy S. Young, vice-president in charge of finance, and Edmund W. Wakelee, vice-president in charge of law, received $43,650 each in 1932, cut this year to $30,000; John L. O'Toole, vice-president in charge of public relations, $24,007 in 1932, cut to $21,037 in 1933, and George Barker, vice-president in charge of real estate and purchases, $20,006 in 1932, cut to $17,531 in 1933.

• Rochester Gas & Electric Corporation's new schedules of lower rates has been approved by the New York Public Service Commission, which body has adopted an order closing a proceeding initiated on the commission's motion concerning the rates and rate structures of this company. The reductions will saves consumers in Monroe, Wayne, Ontario and Cayuga counties approximately $180,000 annually.

• Staten Island Edison Company administrative officials' salaries were increased as a result of their compliance with the NRA code during the last two months, it was revealed last week at a hearing before the Public Service Commission. This and other matters were discussed following the corporation's recent petition for a rehearing on the commission's order directing the company to reduce its rates 10 per cent.

• Columbus (Ohio) Railway, Power & Light Company must accept the lower electric light rates indorsed by the city voters last week or fight them before the commission and the courts. The new ordinance will cut approximately $1,262,000 annually from the Columbus consumers' bills.

• Northern Indiana Public Service Company's suit to enjoin the Indiana Public Service Commission from putting into effect a new rate schedule at Logansport, Ind., was carried to the United States Supreme Court when a dispute arose as to the jurisdictional procedure. The high court has decided the Northern Indiana District Court to have been within its rights when it assumed jurisdiction in a suit brought by the utility company to enjoin the Indiana Public Service Commission from putting into effect a new rate schedule at Logansport. At the time the suit was filed Harry K. Cuthbertson of Peru, Ind., was a member of the commission. The home offices of the company are at Hammond, Ind., and to save traveling expenses and other incidentals the company filed its suit in the northern Indiana district at South Bend. The case was tried in one of the subdivisions at Hammond, Ind. The company asked an injunction to prevent what it termed to be confiscatory rates. The Indiana Attorney-General attacked the suit on the grounds that when Cuthbertson took his position on the commission his residence automatically became Indianapolis, which is in the southern Indiana jurisdiction, and the northern court had no legal right to hear the case. The northern Indiana judge ruled, however, that he was within his rights and heard the case, issuing a temporary restraining order. The state then appealed to the Circuit Court of Appeals, which also upheld the district court, and then the appeal to the United States Supreme Court was taken, which in addition to the jurisdictional question held the rates issued by the commission were confiscatory.

• Milwaukee Electric Railway & Light Company and the Wisconsin Gas & Electric Company, serving southeastern Wisconsin, have been ordered by the Wisconsin Public Service Commission to reduce their rates $266,500. Order affects mostly commercial customers.

Municipal Items

WINTER GARDEN, FLA.—An effort is being made by this city to reacquire the electric light and power plant sold to the Florida Public Service Company in 1929. The city has derived no revenue from the power plant, as it has not been taxed. Florida Public Service paid $300,000 in cash for the plant.

NOBLESVILLE, IND.—Information revealed at a recent meeting of City Council makes it evident that the proposed purchase of the local electric light plant by the city, partly with P.W.A. funds, cannot be carried through. It was originally proposed that the city would take over the local plant, the government would pay 30 per cent of the purchase price and the plant could be bonded for the remaining 70 per cent without any bonded indebtedness being placed on the city. In a letter to Mayor Gifford the federal government stated that a loan could not be made on a going utility, but might be made on a new plant.

SHEFFIELD, ALA.—Alabama Public Works Administration has forwarded to Washington the request of the city of Sheffield, Ala., for a loan of $207,000 with which to build a municipal electric light plant. Permission was also given the Alabama Power Company to file a protest against the loan at the same time. At a meeting of the Alabama Public Works board at Montgomery Frederick I. Thompson, Mobile publisher and a member of the board protesting the plan of the Alabama Power Company to oppose applications of municipalities seeking loans for building electric plants and distributing systems, condemned the company for protesting the application of Sheffield for a loan of $207,000 to build a distribution system from Muscle Shoals. He declared the utility had no legitimate right to protest since it possessed no franchise in the city.

CARUTHERSVILLE, MO.—City Council has adopted an ordinance calling for another election December 12 to vote on a $210,000 bond issue to erect a municipal light plant. This is the third time an election of this kind has been called for the purpose. Two years the bond measure fell short of the required two-thirds majority, and this past spring a second attempt was made and the measure defeated. The Arkansas-Missouri Power Company serves the city.

ALEXANDRIA, IND.—Indiana advisory committee of the emergency works administration will not approve petition for a loan of $250,000 to be used in the construction of a municipal electric plant. The city inaugurated a movement some months ago, hoping to build a new system or buy the property in the city of the Indiana General Service Company. While city officials would make no statement, it is understood another movement is on foot for the construction which will obviate the necessity for a loan. An extensive survey of the city for electrical purposes and needs was made some time ago by a firm of Indianapolis engineers, which recommended the construction. The Indiana General Service Company now has a suit pending in the Circuit Court at Anderson, Ind., requiring the city to show the need of a municipal plant.

BURLINGTON, N. J., rejected a $110,000 municipal plant scheme by a vote of three to one in the election last week.

KNOXVILLE, TENN., will vote November 25 on municipal ownership. One of the prime considerations will be the use of Tennessee Valley Authority power from Muscle Shoals.

SALEM, MO.—Because of widespread opposition, the proposal to have been voted on at last week's election to borrow $40,000 from the Public Works Administration to finance improvements to the light and power plant and the municipal water works was canceled by City Council before election day. The city's application for grant and loan had been forwarded to Washington by the State Advisory Board of Public Works.

CANTON, OHIO—Two initiative petitions calling for an expression of opinion on the establishment of a municipally owned power and gas plant did not go on the ballot at last week's election. The Fifth District Court of Appeals upheld the Stark County Common Pleas Court, which had granted an injunction against placing the proposals on the November ballot.

PROVINCE OF QUEBEC, CANADA—Realtors of Montreal have set up a special committee of five to study the project of municipalization of electricity as urged at the recent province-wide congress of Quebec proprietors in this city under the auspices of the Property Owners' League of Montreal.

RICHMOND, IND.—A 15,000-kw. turbine, together with high-pressure boilers, has been installed in the municipal plant and the entire equipment is to be put into operation within the next month. Work on an underground network system in a section twelve blocks long and two blocks wide is to be started immediately, continuing the employment of a group of men who have been working on the plant extension.

ALTON, ILL.—City Council has approved a recommendation of the Alton Municipal Ownership Commission that the city purchase the water works and distribution system of the Alton Water Company at a price to be fixed by a special committee of three engineers to be selected. The city also contemplates installing a power-generating unit to provide electricity for street lighting should the water works plant be purchased. An application will be made to the Public Works Administration for a grant and loan to finance both projects.

Highway Lighting Provides 43.5 Lumens per Foot

On the new high-speed turnpike between Worcester and Boston, Mass., a 4.5-mile section near Newton has been provided with "non-spill" refractors inclosing 6,000-lumen series lamps which provide 43.5 lumens per foot on this 80-ft. wide roadway. A total of 158 lamps is provided. The units overhang the roadway by about 6 ft. and little flux escapes at the rear or upward due to the asymmetric distribution obtained. Annual cost of operation on this 4.5-mile section is estimated at $9,200. Illumination is sufficiently intense to permit full-dimming of motor headlights.

Arc Arrester Unit Hastens Extinction at Contacts

By G. C. ARMSTRONG

Control Engineer,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

DIFFERING from the usual mechanical action upon the arc is a new arc arrester which becomes a part of the electrical circuit to make the maintenance of the arc impossible. Within the limits of its applicability it makes possible practically arcless performance with the simple, rugged, single break type of contactor.

Physically, the "arc arrester" consists of a small resistor-capacitor unit (Fig. 1) mounted on the base of contactor or linestarter and connected between two poles of the starter or linestarter on the load side of the contacts. Only one unit is required for a three-phase contactor. It also acts to relieve the rupturing difficulty, not only for the contactor or linestarter upon which it is mounted, but also for disconnect or operating switches, for fuses, or any other circuit-rupturing device connected ahead of the contactor. Further, in three-phase reversing service but one arc arrester is required, as it acts with equal effectiveness to relieve either the forward or the reversing contactor. Oscillograms (Fig. 3) show less than one-half cycle arcing with the arc arrester—physically a mere spark—and a persistent arc of five to eight half-cycles without the arrester.

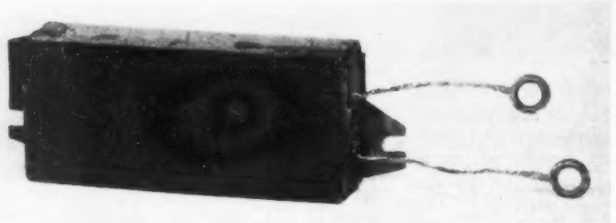
Although capacitators have long been used to relieve arcing when switching small d.c. currents, as, for example, in the ignition systems of automobiles, their use in connection with switches handling power measured in horsepower has been prohibited by the size of the capacitor which, to be effective, appeared to be required. The small size of capacitor required for effectiveness in a.c. switching had not, until recently, been appreciated.

As the current approaches zero the supply voltage has already reversed and is near its negative maximum (assuming all values above the zero line to be positive). The arc voltage is positive and is equal to the algebraic sum of the positive voltage induced by the decrease of current through the reactance and the negative supply voltage (neglecting the small *IR* drop). As the current becomes zero it cannot reverse, because the arc voltage is positive. If the arc voltage could be kept positive the current could never reverse. However, as the current pauses at zero the inductive voltage collapses and the voltage across the arc space reverses, rising toward the instantaneous value of the supply voltage. During the current pause the arc space loses conductivity at a tremendously rapid rate. Whether or not the arc restrikes in the reversed direction depends upon the speed with which the arc voltage reverses and upon the instantaneous value of the supply voltage to which it may rise. This latter is, of course, dependent upon the power factor and the r.m.s. supply voltage.

At the instant the current becomes zero, inasmuch as the inductive voltage is at its peak, the capacitor is fully charged. As the inductive voltage collapses the capacitor discharges through the reactance and delays the collapse, consequently delaying the rise of voltage across the arc space. This is a high-frequency phenomenon and but a small capacitance is required to have a marked effect. In a motor circuit the delay provided by the capacitor is added to the delay afforded by residual current in the motor secondary and eddy currents in the iron. The arc arrester increases the lag in voltage reversal by an amount sufficient to insure extinction at the first current zero in the phases to which it is connected.

With capacitance of sufficient value to be effective, the voltage does not stop at line voltage, but overshoots, then oscillates about the normal value of the supply voltage. This is indicated by the dashed curve in Fig. 5. This overvoltage, by increasing the maximum voltage across the arc space, acts to defeat the purpose of the delayed reversal. This tendency is corrected in the arc arrester by connecting a resistor in series with the capacitor, thereby damping out the oscillation.

In a three-phase circuit a single arc arrester is connected between two phases on the load side of the contactor, as shown in Fig. 4. It is readily apparent that the arc arrester will be equally effective in suppressing the arc in either one of the phases to which it is connected. Its effectiveness with respect to the third phase is not so



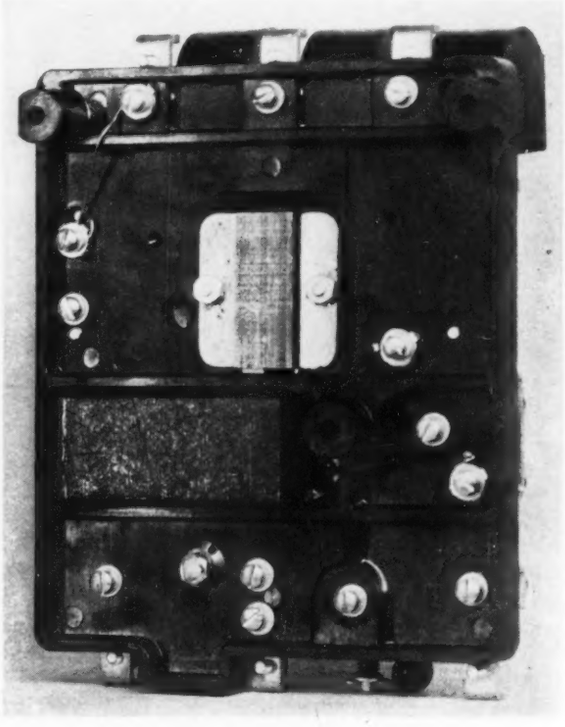


Fig. 1—Arc arrester unit is mounted on the rear of the contactor

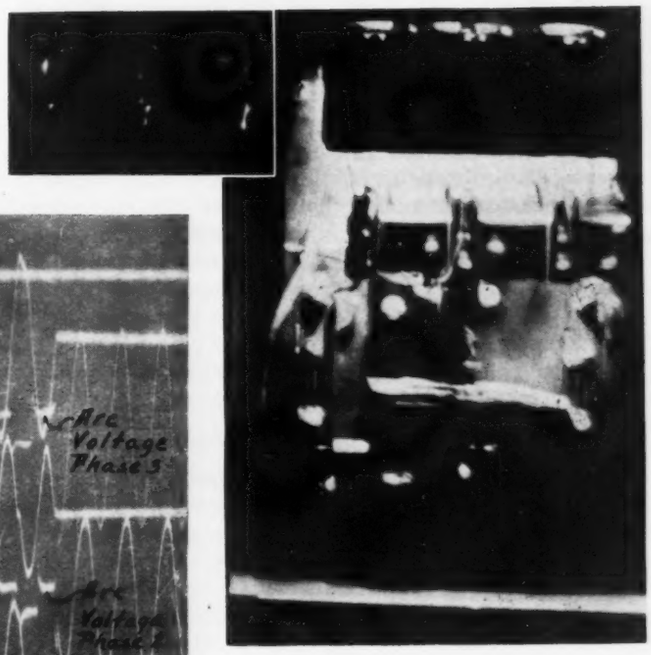


Fig. 2—Flash suppressed by arrester

On the right the contactor is of the conventional type; the one on the left is equipped with the arc arrester. Load identical in both cases

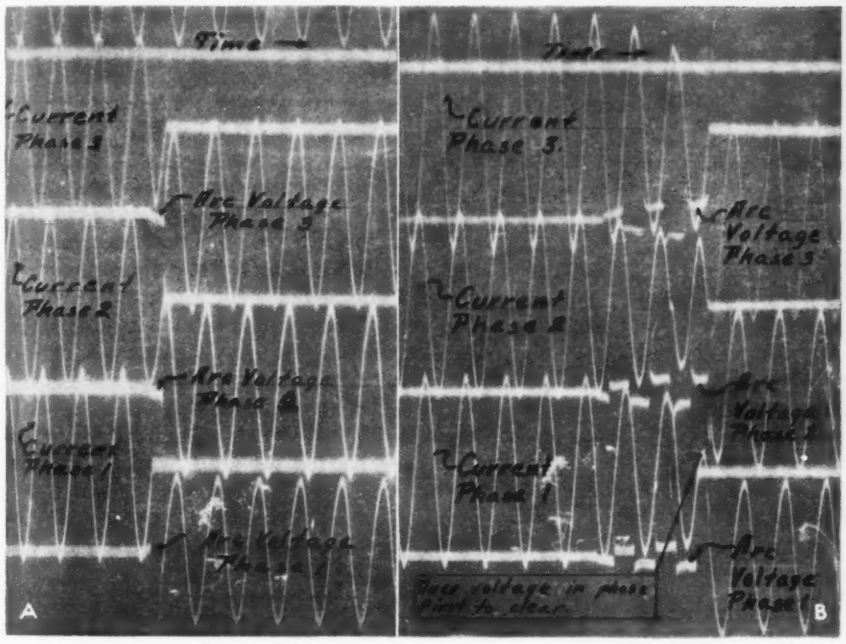


Fig. 3—"Arc arrester" effective in rupturing locked rotor current of a 7½-hp. motor at 550 volts

(A) with arc arrester
(B) without arc arrester

obvious; in fact, depends upon a fact which is perhaps not generally appreciated, and will bear further explanation, namely, the shift in voltage neutral as the first phase clears (Fig. 6).

The first phase to clear offers the greatest rupturing difficulty, or, taking it the other way around, after one phase has cleared the single-phase circuit which remains offers relatively small rupturing difficulty. The arc arrester acting across half of this single-phase load further reduces the difficulty.

Assuming that the arc impedances are small and the same in all three phases, the transition from three phase to single phase as the first phase clears involves no current transient. At that instant the currents in the two legs which then comprise the single-phase circuit are (as viewed from the wye junction) opposite in direction and each equal to 0.866 times the normal peak value. But in this single-phase circuit 1.73 times the previous (r.m.s.) phase voltage is acting on twice the impedance, so that the peak value of the single-phase current will be just 0.866 times the peak value of the three-phase current. But it happens that the normal time for the peak of this new current occurs just at this instant, for the single-phase voltage is the difference between the component three-phase voltages and leads one by 30

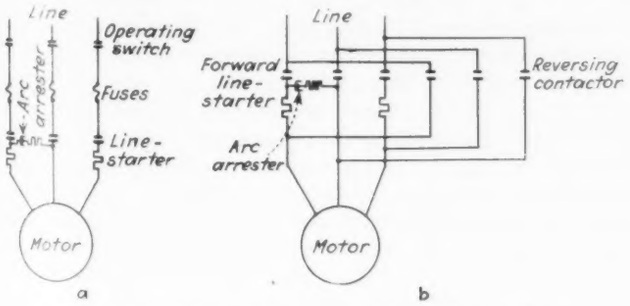


Fig. 4—Only one arrester unit on three phase

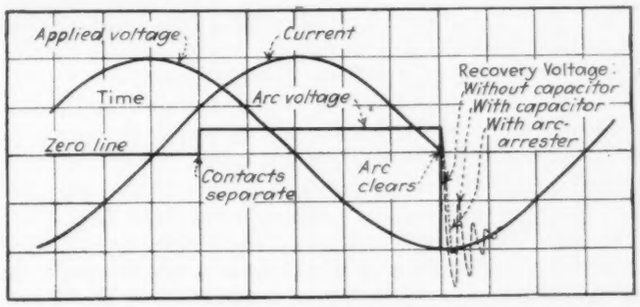


Fig. 5—Arrester resistor damps out recovery voltage oscillations

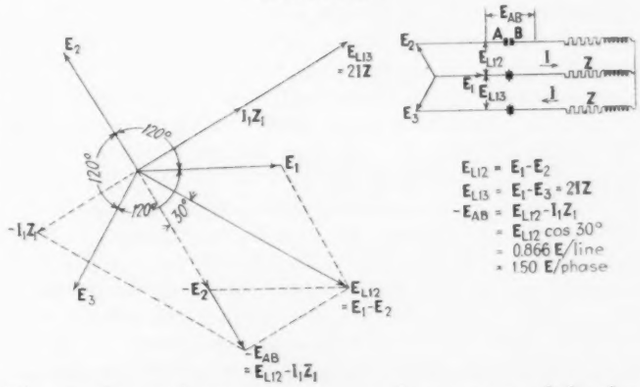


Fig. 6—Overvoltage occurs across the contacts of the first phase to clear in a balanced three-phase circuit with open neutral

As the first phase clears an overvoltage of 50 per cent appears across the arc space. Simultaneously the voltages across the other contacts drop 13 per cent. In an induction motor these relations are slightly modified by the influence of residual currents in the rotor. The phase shift is clearly indicated in the oscillograms of Fig. 3

deg. and the other by 150 deg., the new current is shifted in phase by the same angle, making its peak occur at the instant the current in the first phase of the three-phase circuit passes through zero. Inasmuch as its peak value is equal to the instantaneous value of the three-phase current the transition requires no transient.

From this analysis it is evident that the single-phase current passes through zero just ¼ cycle after the first phase clears, and, assuming that all three sets of contacts open simultaneously, the maximum possible arcing time for any phase is 5/6 of one-half cycle and the minimum for normal arcing (i.e., with low arc impedance) for the last two phases to clear is ¼ cycle.

Because the a.c. arcing is mild at 110 and 220 volts, (three-phase) the arc arrester is not in general necessary at these voltages.

Arcs much affected by circuit characteristics

A.c. arcs may vary greatly in characteristics in different circumstances. One may bluster and roar, yet be snuffed out with the slightest effort; another may be quiet and mild in appearance, but hang on with dogged determination, and still another may look bad and be just as bad as it looks. Arc-rupturing difficulty is an intangible thing, hard to estimate or predict, and affected by a great variety of factors which are inextricably related. Sometimes what may seem slight or unimportant changes in circuit conditions may have an extremely important effect upon rupturing difficulty. The more important of the factors affecting rupturing difficulty of industrial a.c. circuits are voltage, current, power factor, distributed capacitance and circuit arrangement.

Recent tests have disclosed that arc-rupturing difficulty is not directly proportional to voltage, but, other conditions remaining constant, to supply voltage minus a constant. This constant depends upon the number of contacts per phase, the material of the contacts and, to a relatively small extent, upon the value of the current. It is to be noted that it is not the r.m.s. voltage but the instantaneous recovery voltage available to restrike the arc after the current zero which determines rupturing difficulty. For copper contacts the constant is approximately 160 volts per contact. As has been shown, in a three-phase circuit, as the arc in the first phase clears, the voltage neutral instantly shifts, dividing the resultant single-phase voltage between the two remaining arcs, and raising the voltage by 50 per cent across the contacts of the first phase to clear. For a single break per phase, and copper contacts, the rupturing difficulty is therefore approximately proportional to r.m.s. line voltage times 1.22 minus 160. Thus, in a three-phase circuit of zero power factor, the arc will extinguish at the end of the first half cycle after the contacts separate at all voltages below about 135 r.m.s. In a single-phase circuit the voltage for zero-rupturing difficulty at zero power factor is about 115 r.m.s.

Variation of rupturing difficulty with current is much more complicated. The voltage required to maintain an open arc of fixed length decreases rapidly with variation of current from zero to about 25 amp., but for currents above this value it decreases much more slowly. It is, therefore, to be expected that the smaller the current is below 25 amp. the more easily it may be ruptured, but that the arc length for extinction should not vary greatly for increasing current above this value. However, practically, many conditions have a material bearing upon the problem.

In the first place the smaller the current the less rapidly the arc may be moved by a given magnetic blowout field. Consequently in switches designed for high currents the arcing time may be many half cycles for low currents, but only one or two for high currents. Further, commercial contactors are designed for definite current ratings and to meet definite rupturing specifications. These specifications determine the switch size and proportions. The section of an arc increases with increasing current. Confining the arc between insulating refractory walls decreases, in general, the arc length required for extinction. Inasmuch as the higher the current the more the restriction exerted by the switch structure, increasing current may appear to decrease rupturing difficulty. On the other hand, however, increasing current results in increased heating, and sometimes destruction, of the arc inclosure, with resultant decrease in rate of deïonization of the arc path, so that, in general, for a particular contactor, after a certain current is exceeded, arc-rupturing difficulty becomes increasingly difficult until, finally, rupturing failure occurs. Increased evolution of gases resulting from higher currents also increases the danger of flashover. Therefore, although in theory arc-rupturing difficulty increases but slightly for current increases above 20 to 30 amp., practically the difficulty varies in a somewhat erratic way which is dependent almost entirely upon the design of the contactor. It is in general true, however, that rupturing difficulty is relatively insensitive to moderate changes in current values—much less sensitive than to changes in voltage or power factor.

Impedance components also a factor

Changes in circuit arrangement may have a very marked effect upon rupturing difficulty, even though current, voltage and power factor remain unchanged. An infinite number of circuit arrangements may be made which will possess any given impedance and power factor. If resistance and reactance are placed in parallel they carry currents which are out of phase with each other, and the sum of their currents go through zero at a time different from either of them. The arc clears as the total current becomes zero and leaves a residual d.c. current flowing in the resistor-reactor circuit which effectively delays the recovery of voltage across the arc space and greatly decreases the rupturing difficulty of this type of circuit as compared with a series circuit.

A similar phenomenon occurs in the case of a motor with locked rotor. The primary current which is interrupted by the switch is made of two components—the magnetizing component, which, because of the air gap between stator and rotor, is large as compared to that of a transformer, and the load component, which sets up a flux neutralizing the flux set up by the current in the secondary. The primary current therefore passes through zero at a different time than does the secondary current. The arc suddenly interrupts the primary circuit as the current becomes zero and a residual current is left to circulate in the secondary. This current retards the collapse of flux in the motor and delays the rise of the reversed arc voltage in a manner similar to that of the shunted circuit discussed above. It, therefore, is very much easier to interrupt the circuit of a locked rotor motor than a circuit of the same impedance consisting of an air core reactor and a resistor in series.

The circuit of a running motor is even more easily

ruptured for several reasons, the most important of which is the fact that this residual d.c. current which continues to flow in the secondary after the primary current is interrupted results in a counter-emf. in the primary which reduces the voltage across the contacts of the switch to a very small fraction of the total line voltage.

In most other types of engineering work the effect of the distributed capacitance of a circuit is of negligible importance. It is, therefore, natural to question its importance in arc-rupturing problems. However, tests indicate that it has a relatively large influence on arc-rupturing difficulty and is of great practical importance in the design and use of standard industrial contactors. It is the more important because of its elusive, unmeasurable value. Nor is it easy to predict, even qualitatively, much less quantitatively, the relative rupturing difficulties which may result from apparently unimportant changes in circuit arrangement. For example, merely interchanging the position of reactors and resistors in a series circuit may have every marked effect upon the comparative rupturing difficulty. It is important to realize in making tests of contactor performance that, in general, circuits containing air core reactors are much more difficult, and circuits containing oversaturated iron core reactors may be less difficult to rupture than locked rotor motors having the same power factor and current.

Power factor may affect rupturing difficulty in two ways. First, at a given current, it determines the value of the inductance in the circuit. In the case of a contactor using a powerful blowout field it therefore affects the inductive voltage and the time required to force the current to zero. In this case rupturing difficulty may be said to be approximately proportional to the sine of the power-factor angle. In the case of contactors which operate upon the principle of extinction at the current zero power factor affects rupturing difficulty by determining the value of the reversed voltage which appears across the contacts as the arc clears. This instantaneous recovery voltage is proportional to the sine of the power-factor angle. The rupturing difficulty, as previously stated, is for copper contacts, proportional to this voltage minus 160 volts (approximately). Hence, the rupturing difficulty is proportional to the maximum value of the instantaneous voltage times the sine of the power-factor angle minus 160. Neutral shift must of course be considered in three-phase circuits.

With the single break type of contactor reserve rupturing capacity can be incorporated to meet the requirements of difficult circuits and, in addition, by means of the "arc arrester," obtain practically arcless performance in jogging service, thus combining electrical reliability and mechanical simplicity with long life of contacts.

▼ ▼ ▼

Tap-Changing Transformer Used as Phase Shifter and Voltage Regulator

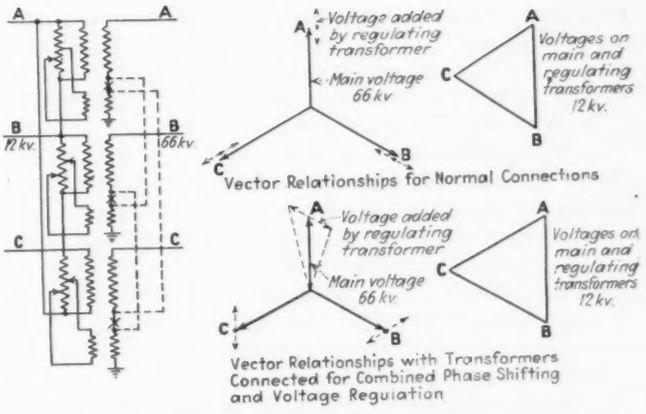
By A. G. COULSON AND E. L. MICHELSON

System Development Division, Engineering Department, Commonwealth Edison Company, Chicago

Some time ago the Commonwealth Edison Company experienced difficulties in properly loading the transformers and lines that supplied the Fisk Street station. This difficulty was due to the 66-kv. bus operating in two sections at Fisk station and supplying a common 12-kv. bus. The sections of the 66-kv. system had different impedances, but were supplied from the same generators at Crawford and State Line. Varying the voltage of the tap changers increased the reactive circulating current in the lines and transformers, but had very little effect on the kilowatt load division.

To overcome this difficulty the following scheme was tried and is now operating successfully at Fisk Street station. Existing equipment was reconnected to operate as a combined phase shifter and voltage regulator and thus compensate for the unequal phase displacement of the two 66-kv. sections and obtain proper balance of the loads on the transformer and lines.

The installation consists of three single-phase, 20,000-kva. transformers with a three-phase 10 per cent regulating transformer with $2\frac{1}{2}$ per cent steps. Normally the 66-kv. series windings of the regulator are connected either in phase or 180 deg. out of phase with the main voltage. With the new connection the regulator voltage either leads the main voltage by 60 deg. or lags by 120 deg. These phase relations are shown by the accompanying vector diagrams. With the regulator connected for combined phase shifting and voltage regulation the main voltage can be varied between 105.4 per cent with a leading angle of 4 deg. 40 minutes and 95.5 per cent with a lagging angle of 5 deg. and 14 minutes. The changes in voltage and phase angle are simultaneous and there are a total of nine steps. The amount of power transferred by a shift in angle depends upon the impedance of the system involved. To obtain the phase shifting the existing connections of the regulating transformer were opened at points X in the schematic diagram and the 66-kv. windings reconnected as shown by the dotted lines.



Voltage regulator becomes phase shifter also

Connections were broken at points X and 66-kv. side reconnected as shown by dotted lines.

Two-Phase Riser Loads on Three-Phase, Four-Wire Secondary Network

By LESLIE J. WEED

Electrical Engineer,
Edison Electric Illuminating Company of Boston

BALANCING the riser load in any large new building on all three phases of a three-phase, four-wire, a.c. secondary network system is always desirable. In the case, however, of existing buildings which are supplied from the d.c. system the interior wiring usually already consists of the positive, negative and neutral wires. If these three wires could be connected to two phases and the neutral of the network system the wiring changeovers would be materially reduced. In meeting this situation in Boston a technique has been devised which discloses the relationship between the loading and the resulting unbalance in voltage of the two phases.

When load is supplied from two phases of a three-phase, four-wire system the neutral will carry current, and if the load is balanced on the two phases, then the neutral current will be numerically equal to and displaced vectorially an equal amount from either phase current.

The impedance drop produced by this neutral current when combined with the impedance drop in each of the two phase conductors will give rise to unbalanced voltages at the load, which is an undesirable condition and one which may cause some confusion unless the reason for this unbalance is clearly understood. The vector diagram for this condition is shown in Fig. 1.

In order to determine just how much effect the unbalance disclosed in Fig. 1 would have on the phase voltages of an actual installation supplied from an a.c. secondary network, a study was made for various sizes of interior wiring from No. 4/0 up to 1,000,000 circ.mil, assuming that all three cables were of the same size and that they were pulled into the conduit in such a manner that all three were in contact to form equilateral spacing without any transposition.

Inasmuch as I_A and I_B are equal in magnitude, I_N must be of the same magnitude and displaced 60 deg. from each current vector, and will remain in that same relative position regardless of the change in power factor. If then, instead of calculating the voltage drop in the phase wire and in the neutral, either by the rectangular or polar method, and then taking the sum of these voltage drops, we take the vector sum of the phase and neutral currents, which is constant in magnitude and swings directly with the power factor, and multiply this by the impedance in polar form (which is the same for both conductors), the voltage drop is obtained directly for any given power factor.

Two-phase drop in neutral computed

In view of the fact that the impedance of each of the three conductors is the same for any particular size of

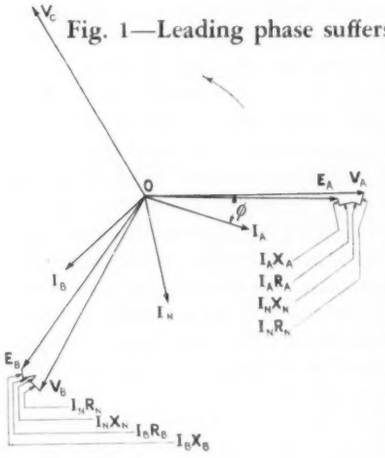


Fig. 1—Leading phase suffers most in voltage drop

V_A, V_B and V_C represent the network voltages and E_A and E_B represent the load voltages. I_A and I_B represent the load currents assumed balanced, at a power factor equal to cosine θ, and I_N represents the resultant neutral current. I_AR_A and I_AX_A represent the resistance and reactance drops respectively in the A-phase cable, I_BR_B and I_BX_B represent the resistance and reactance drops respectively in the B-phase cable and I_NR_N and I_NX_N represent the resistance and reactance drops respectively in the neutral cable.

E_A is somewhat less than E_B, although the load is the same on both phases. As the power factor of the load improves, I_A, I_B and I_N swing in a counter-clockwise direction, and while this has little effect on the magnitude of E_A, it does tend to increase E_B to such an extent that at around unity power factor E_B may be equal to or possibly greater than V_B, depending upon the relative magnitudes of the resistance and reactance of the phase and neutral conductors. When the impedance angle—that is the angle whose tangent is equal to the ratio of reactance to resistance—is 60 deg. E_B will be equal to V_B at unity power factor regardless of the load or the distance from the load to the source of supply.

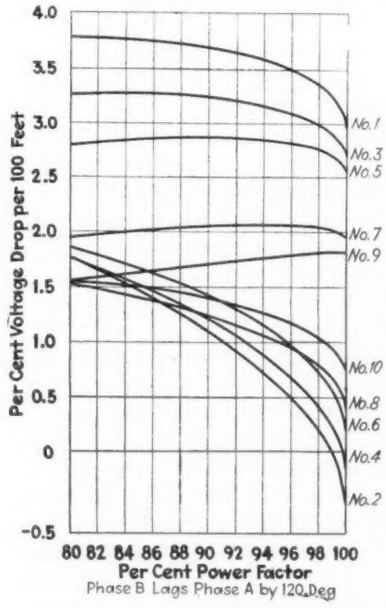


Fig. 2—Lagging phase voltage most affected by power factor of load

As the power factor decreases the voltage drop on the lagging phase increases quite rapidly, and finally becomes equal to the voltage drop on the leading phase. The voltage drop on the leading phase will be equal to the voltage drop on the lagging phase when the power factor angle becomes equal to the impedance angle of the particular conductors involved.

Curve 1 — 1,000,000-circ.mil cable with 800 amp., phase A
Curve 2 — 1,000,000-circ.mil cable with 800 amp., phase B
Curve 3 — 750,000-circ.mil cable with 650 amp., phase A
Curve 4 — 750,000-circ.mil cable with 650 amp., phase B
Curve 5 — 500,000-circ.mil cable with 500 amp., phase A
Curve 6 — 500,000-circ.mil cable with 500 amp., phase B
Curve 7 — 350,000-circ.mil cable with 300 amp., phase A
Curve 8 — 350,000-circ.mil cable with 300 amp., phase B
Curve 9 — No. 4/0-circ.mil cable with 200 amp., phase A
Curve 10 — No. 4/0-cric.mil cable with 200 amp., phase B

cable, a formula has been derived which offers a much simpler method for calculating the voltage drop E_1 in the *leading* phase of a three-phase, four-wire, network system supplying balanced load on only two phases.

Let I_A = current in phase A = current in neutral
I_B = current in phase B = current in neutral
$Z \angle \phi$ = impedance of the conductor in polar form
ϕ = power factor angle
E_1 = voltage drop in the leading phase
E_2 = voltage drop in the lagging phase

$$E_1 = \sqrt{3}\, I_A Z \angle \phi - 30° - \theta \qquad (1)$$

In order to calculate the voltage drop in the *lagging* phase, it is merely necessary to rotate the vector diagram through 120 deg. in a positive direction and use V_B as the axis of reference.

$$E_2 = \sqrt{3}\, I_B Z \angle \phi + 30° - \theta \qquad (2)$$

From these above equations the voltage drop on any size cable can be calculated for any load (assumed balanced) at any power factor.

Curves showing the percentage variation in voltage drop on each phase as the power factor of the load is changed are given in Fig. 2. These curves indicate very clearly the possibility of obtaining a load voltage which may actually be higher than the supply voltage on the lagging phase, but it is also obvious that this condition exists only in the case of very large conductors, and at somewhat higher power factors than will normally be encountered in such installations.

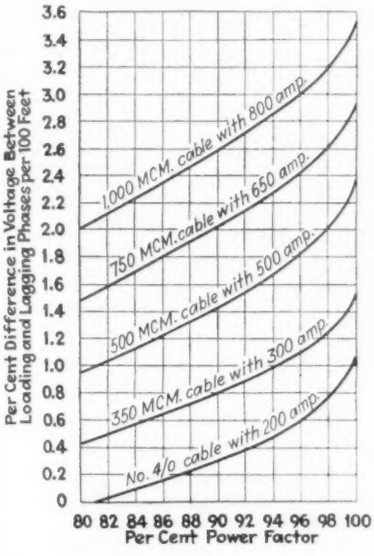


Fig. 3 — Unbalance more prominent with the larger conductors

Curves show the differences in voltage which will occur between the leading and lagging phases per 100 ft. for the same conductors and loading as in Fig. 2.

The curves in Fig. 3 show the differences in voltage which will occur between the leading and lagging phases per 100 ft. for the same conductors and loading conditions as in Fig. 2. Even with 1,000,000-circ.mil conductors fully loaded there would be a maximum of 3 per cent voltage unbalance between phases per 100 ft. for power factors which normally would be encountered, and as the load or power factor decreases the voltage unbalance would be much smaller. In the case of the smaller conductors the voltage unbalance is so small as to be entirely disregarded, even under full load conditions, as a greater unbalance than this might readily be expected from the normal loading conditions which inherently prevail on the existing d.c. system.

However, in those cases where it is desired to avoid even a slight voltage unbalance or where the risers are sufficiently long to cause a serious unbalance there are several methods by which this unbalance may be overcome, the most satisfactory of which would be to install the fourth conductor and balance the load on all three phases. This method also has the advantage of making it possible to supply more load from the existing risers.

If the arrangement of the existing building wiring should be such that it would not be practicable from either an engineering or an economic standpoint to add the fourth conductor, and balanced voltages were desired, a single-phase regulator could be installed in the leading phase and adjusted to compensate for the excess in voltage drop of that phase over the lagging phase.

▼

Gas-Filled Cable Tested in England

A so-called gas-filled cable was briefly mentioned in a discussion before the British Institution of Electrical Engineers recently by C. J. Beaver of W. T. Glover & Company, Manchester. The dielectric is built up in the usual way with lapped paper, but it is impregnated before application with a solid compound which is said to remain physically stable up to temperatures far greater than encountered in operating cable. The gas spaces are those between the edges of the convolutions of paper and their thickness corresponds to the paper thickness. Over the dielectric is a metallic screen, surrounded by the lead sheath which is bound with 4-mil brass tapes to reinforce it against internal gas pressure. The usual protective tapes are applied over all. Nitrogen gas is pumped into the cable after installation and sealed off, without any provision for reservoirs or compensators.

Performance tests of factory lengths laid in the ground have been made. For example, a 0.2-sq.in., 66-kv., single-core cable with 0.35-in. insulation was filled with nitrogen at 90 lb. per square inch, and loaded up to 75 deg. F. at 1.1 times operating voltage and subjected to 150 loading cycles. It was reported to maintain a perfectly flat power-factor-voltage characteristic up to twice operating voltage, showing no signs of ionization. Another similar cable, except for 0.15-in. dielectric and 200 lb. per square inch gas pressure, showed no detriment to the power-factor-voltage characteristics after 50 loading cycles (up to 65 deg. F.), which had been made at the time the report was made.

The great reduction in dielectric thickness was made, said Mr. Beaver, to enable combining a time-voltage breakdown test with the loading cycle. The maximum dielectric stress was 140 kv. per centimeter, or three times that in ordinary 66-kv. cable at operating voltage. The diameter of this cable, outside the lead sheath, is 1.1 in., compared with 2.1 in. for the usual cable. Surge-voltage tests up to a peak value of 108 kv. produced no effect on the power-factor-voltage characteristic, it was reported.

Among the advantages claimed for the cable were: (1) Compressible gas prevents lead-sheath distortion; (2) compound does not move radially or longitudinally with temperature change; (3) heating cycles produce no

alteration in the power-factor-voltage curves, which remain flat up to value determined by gas-film dimensions and pressure; (4) no interaction of gas and compound because of absence of ionization; (5) no time effects on power factor with changes in voltage; (6) no variations in internal pressure from place to place; (7) no low-pressure critical point due to temperature; (8) physical gradient or vertical length of cable does not affect characteristics; (9) thermal resistivity is comparable to ordinary cable and temperature gradient is good.

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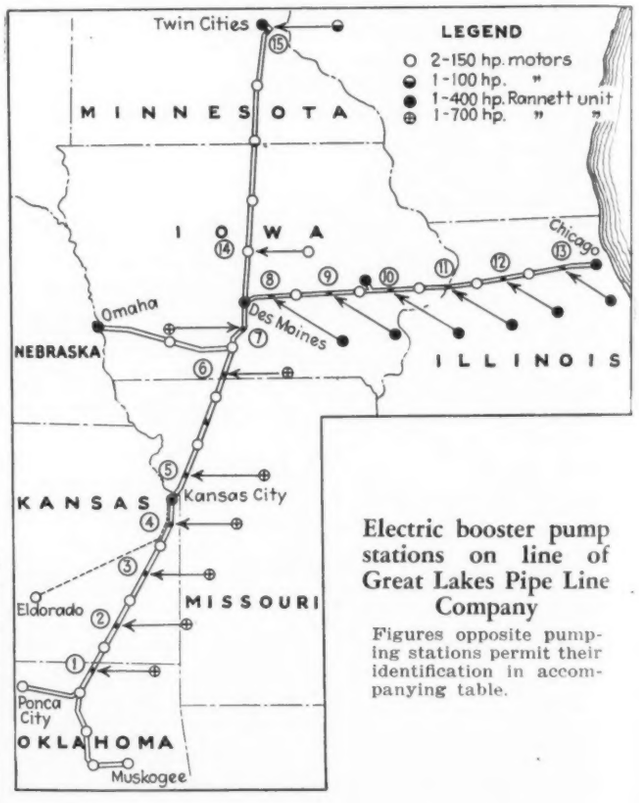
Fifteen Electric Booster Pumps on Great Lakes Pipe Line

Through the work of the Petroleum Electric Power Club a significant accomplishment in electric pipe line pumping has been achieved. When the capacity of the Great Lakes Pipe Line Company's line from Oklahoma terminating in Omaha, Nebraska, St. Paul, Minnesota and Chicago was raised the job was done with electric pumps. The accompanying map shows the locations of the new pumps, thirteen of which are of the "Rannett" type, described on page 358 of ELECTRICAL WORLD, March 18, 1933. One great objection that pipe-line operators have had against electric service was that all power companies along the line insisted on using forms of rates and contracts different from the others. The result of this was that it was extremely difficult for the pipe line company to determine operating costs or to forecast them. Much of the effort of the P.E.P.C. has been toward simplification and uniformity of rate and contract forms for pipe-line service. How successful this effort has been is demonstrated by the accompanying tabulation, which shows the different utilities serving the booster stations of the Great Lakes Pipe Line Company under contracts of uniform wording.

Utilities Serving Booster Stations of Great Lakes Pipe Line Company

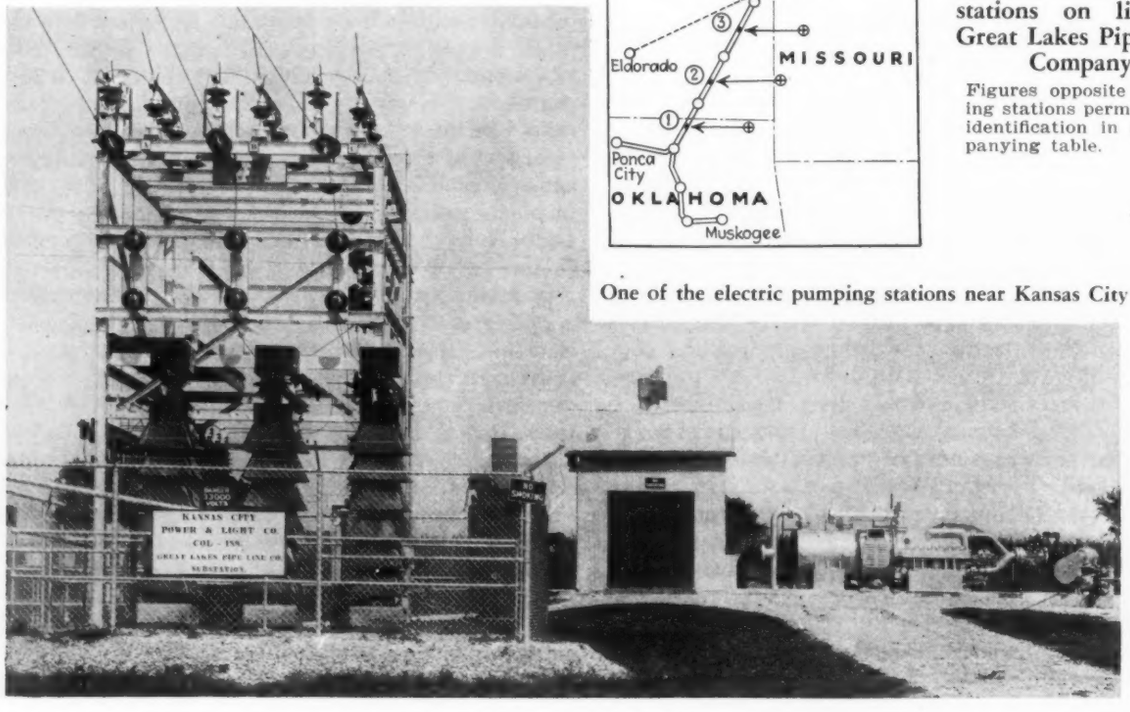
The pumping stations may be identified on map by corresponding number.

Pump Station, Name	Location: State of	Location: Near Town of	Power Service Rendered by Utility Company	Hp.
1. Copan	Oklahoma	Copan	Public Serv. of Okla.	700
2. Altoona	Kansas	Altoona	Kansas Gas & Elec.	700
3. Slema	Kansas	Slema	Kansas Utilities Co.	700
4. Bonita	Kansas	Kansas City	Kansas City Pr. & Lt. Co.	700
5. Smithville	Missouri	Kansas City	St. Joseph Ry. Lt. Ht. & Pr. Co.	700
6. Lamoni	Iowa	Osceola	Iowa Southern Utilities Co.	700
7 Indianola	Iowa	Des Moines	Des Moines Elec. Lt. Co.	700
8. Prairie City	Iowa	Des Moines	Des Moines Elec. Lt. Co.	400
9. Guernsey	Iowa	Iowa City	Iowa Elec. Lt. & Pr. Co.	400
10. West Branch	Iowa	Iowa City	Iowa Elec. Lt. & Pr. Co.	400
11. Cordova	Illinois	Cordova	RockRiver Elec. Lt. & Pr. Co.	400
12. Eldena	Illinois	Streator	Illinois Northern Utilities Co.	400
13. Elburn	Illinois	Chicago	Illinois Pr. & Lt. Co.	400
14. Roland	Iowa	Roland	Iowa Elec. Lt. & Pr. Co.	300
15. Newport	Minnesota	St. Paul	Northern States Pr. Co.	100



Electric booster pump stations on line of Great Lakes Pipe Line Company

Figures opposite pumping stations permit their identification in accompanying table.



One of the electric pumping stations near Kansas City

Sales—More Volume and More Profit

By L. W. W. MORROW*
Editor ELECTRICAL WORLD

WE KNOW that sales of appliances amounting to $10 or $15 a year per customer with an annual increase of 20 to 30 kw.-hr. per customer are not satisfactory and do not meet our expectations or necessities. Yet this is our present rate of selling. We would like to sell $200 worth of appliances to each customer and increase his energy use 2,000 to 3,000 kw.-hr. per year and we would like to do this in the next year or two. We know these are reasonable sales and energy use possibilities from our market data. We know the products and services are competitive. Why, then, can we not develop a practical business plan for making sales at this rate and in this volume?

Opinions on what to do

A first and very reasonable approach is to ask appliance manufacturers for suggestions, so I wrote some executives recently, stated the conditions and asked them what they would do or would suggest be done if free to act without any handicaps of past practices. I asked them for a practical plan and method to sell rapidly and to sell a very large volume. A typical reply was to the effect that the only way to get the results desired was to increase the mark-up on each appliance very largely so that money would be made available for the necessary promotional and sales efforts. A frank admission was made that no appliances at present prices could be pushed to a larger volume and a more rapid sales rate because losses instead of profits would be the return to sales agencies. For example, to sell a $50 electric washing machine on the scale proposed would necessitate an increase in price to $125 to support the effort on a profitable basis. Yet the manufacturers admitted that these price increases were not feasible or practicable. This suggestion, therefore, contained a big "if" that could not be overcome.

Another typical reply was that the utility should support the necessary promotional and sales efforts even at a large loss as a merchant, since it derived revenue from kilowatt-hour sales over several years. No thought was given to the fact that the state commissions and the chief executives of utilities will not permit this action, to say nothing of the general principle that any product sold should stand on its own feet to be a valid business.

Thus the manufacturers frankly admitted that utilities have sold major appliances for years at a loss as merchants, that it is impossible to raise prices on appliances sufficiently to enable any one to sell the market at a very rapid rate and that they have no practical business plan to accomplish the industry objectives I have outlined.

But what about the utility commercial men? I wrote to 20 or 30 experienced utility commercial managers asking them what they would do if free to act. Most of them admitted frankly that the objective could not be accomplished with present methods and with present margins without great loss. One said he did not believe in special schemes or methods and that it must be done in the orthodox way by more continuous and greater efforts at selling, but he did not give any answer to the question as to costs involved and how to do this profitably. Still another suggested scrapping old methods and, for example, borrowing $1,000,000,000 from the R.F.C. to finance sales of appliances and wiring on an amortization basis and thus give a complete electric service to all homes through a wholesale and joint industry effort. But when all these ideas were considered there was no definite and practical plan for wholesale and rapid market development to be had from utility commercial men.

Special plans point to new departures

Next, it is interesting to turn to the special efforts found in the field to find out if any one is selling the market at the rate desired. And it is to the credit of utility men that all these special efforts originated in utility ranks and were applied by utilities. There is the San Joaquin plan in which aggressive and co-operative selling is supported by a direct payment to sales outlets by the utility in proportion to added load. We have the Richmond plan, in which the Morris Plan banks finance all unpaid balances of $75 or more at 6 per cent per annum plus a 1 per cent fee. We have the Poughkeepsie plan, in which the utility finances unpaid installment balances at 8 per cent plus 2 per cent for losses and encourages the all-electric home idea. Then we have the rental plans of Hartford Electric Light Company, Central Maine Power Company and others. And we have outstanding local co-operative efforts such as have been developed in Philadelphia and Cleveland. All these are thoughtful and constructive efforts to sell local markets and should be encouraged for they make for progress.

But when one tries to measure the results obtained by any of these plans, either in terms of actual sales or of a realization of what is desired in selling, it is disappointing to find that the rate and the volume fall short of expectations and surpass slightly, if at all, the actual sales results obtained in other localities. They fail to obtain a rate of business growth that the industry finds desirable or believes possible. This is the fault of conditions and the system under which sales must be made and is not an indictment of those in charge of the plans.

Thus, after consulting the best advice available and after studying the methods in use at first glance, one is forced to conclude:

1. With present methods of distribution and sales it is very difficult to increase the rate of market development at a profit.
2. No proved new plans or new methods are available to sell the markets more rapidly or in greater volume.
3. Experimental methods that involve major changes in distribution for selling the market have not succeeded in the degree

**Abstract of paper presented before Pennsylvania Electric Association.*

desired and cannot be used or developed quickly enough to be effective.

If these conclusions are correct, what can be done? Shall we go on as we are and be content with the present rate of acquisition of new business? Shall we continue to try out some more new ideas and more experimental plans to change our methods and improve the economics of distribution so as to expedite sales enormously and profitably? It must be remembered that whatever we do must be done quickly and must be practical, and that any method, to succeed, must give value to the buyers and must make profits for the sellers.

No short cuts available

In my opinion we must encourage the development of the market both by a fuller use of present methods and by use of new methods. We must use the tools and methods that exist and develop them to get business more quickly and more effectively. We have no time to experiment on a national basis, but must sell at once. To do this we must carry out the definite program required in all selling:

1. Customers must be sold on the electrical idea and on the use of electrical equipment.
2. Sales must be financed adequately and economically for all agencies.
3. An adequate, competent staff of salesmen must be available for selling.
4. Devices and products must be satisfactory in price, performance and construction.
5. Electric rates must be competitive as well as the price of electrical products.
6. Sales practices must be established and all sales agencies must be focussed on the market and yet compete on a fair and profitable basis.
7. Products and services sold must be kept sold and kept in use so as to give full value to buyers.
8. Selective marketing and multiple selling must be used to reduce costs and get volume of sales profitably.

Effort must be local

In the present complicated national situation I believe actual market selling must be largely a local effort. Only certain stimulating policies and broad plans may be expected from the national organizations or companies. The fall campaign for better lighting, the refrigeration program, the cookery program and other efforts are sketched broadly at national headquarters, but must be applied locally to be successful. Each community is a market with its own particular conditions and must exert its own efforts and devise its own detail plans to get business. This policy is sound, because the closer sales agencies are to customers the better and more practical will be sales plans. Sales must be made to satisfy customers, not manufacturers or utilities.

A cross-section of each community shows stores, homes and offices inhabited by people. These citizens are trying to get ahead, trying to match income and outgo, trying to educate children, trying to buy a car—most of them are not sold on electrical ideas or equipment and are not concerned or even aware of the fact that the electrical industry frets because they do not demand all the products and services available. The start of market development, therefore, is to sell the people a desire for electrical products and services. This is promotional effort and sales cannot be made without it. Just recall the millions of dollars and the time and effort spent on selling the public the idea of food conservation through refrigeration. Then followed equal expenditures to make the public wish to have electric refrigeration. It is the style, it is the thing today, but do not forget that this is so because of organized promotional efforts that took time, man-power and enormous sums of money. At the lowest estimate I should say that this cost was equal to direct sales cost and is comparable to manufacturing cost. It amounted to nearly 20 per cent of list prices of refrigerators sold.

Low prices will not sell

One of the greatest errors made by utilities and by manufacturers is the assumption that a low-priced product or a low electric rate will sell of itself. It will not unless consumer desire to buy is created through promotional effort. If you offered an electric range and electric water heater free at a low rate to customers on any property where there has been no consumer demand created I doubt if even 10 per cent of the customers would accept the gift or use the appliances. Money and skilled advertising and sales talent must be used to create consumer demands for new things before they can be sold.

We have evidence of this in vacuum cleaners and washing machines. Competition forced down margins and product prices and thus eliminated sales pressure and promotional work—it made demonstration selling and house-to-house canvassing unprofitable. The result was a good product at less than half the original price, but with sales decreased both in number of units sold and in dollar volume. Any pioneer or new major appliance must be sold by first creating consumer demand and, second, by a very expensive type of demonstration and specialty selling. Only when consumer acceptance is complete and saturation is on the order of 30 per cent can these appliances be sold by placing them, like lamps, in retail outlets accessible to consumers who buy of their own volition. This is a first principle of merchandising, established by experience that is most frequently violated in practice.

Each service or device requires this kind of promotion expenditure and effort to make sales. Can we afford to do this on individual items, such as the range, water heater, air conditioner? Can we lump together these devices under a slogan, such as the "all-electric home," to save time and money through multiple selling? We must do both. But above all, we must do this promotional work and spend a great amount of money to do it and each agency in the industry should share in this cost and help in this effort. The public, however, must pay the bill ultimately, because this expense is a big and definite cost that must be included in sales prices.

Local outlets should organize

Granted, then, the necessity of organized promotional effort tied into practical sales plans in each community, we then reach our present firing line of sales—the local sales outlets. These must organize to do the sales work. They must establish sales and purchasing policies and practices. They must devise a mechanism for financing, warehousing, servicing, installing and repairing the products sold. To reduce costs per outlet and to get profitable sales, it is essential that local sales outlets get together in some form of organization. The idea of NIRA for national business must be applied to local business. Fortunately at no time in the past has the industry more definitely recognized this need for local

co-operation, and in most instances local groups are ready for teamwork in the marketplace. They are willing to buy, sell and finance upon the same basis and to turn their attention from internal quarrels to the more profitable occupation of selling.

In this local group lies the key to rapid market development. The utility, the department store, the dealer, the drug store, the hardware store and the distributor and other outlets must do their own selling. They will do it if organized, if stimulated and if faster selling proves profitable to each of them. You cannot expect a dealer, for example, to contribute to promotional effort, to put on a sales staff and to force business if this is not profitable. But neither can you expect any one but these local sales agencies to write the ticket that will enable them to do business profitably. They must develop or adopt their own plans and methods and demand what is needed to make the plans successful from the manufacturer and wholesaler to enable them to do a profitable business. But this must be done on the assumption that their plan is sound and that they will sell if given opportunities to do so profitably.

Most of the present maladjustments in distribution and lack of aggressive market development results from the fact that these local outlets have not asserted themselves and have not developed their programs. They have been dominated either by the manufacturer or the utility or they have been inert and calmly accepted existing conditions. The national manufacturer established one or more sales mechanisms, depending upon the year, and the wholesaler and his affiliated local sales outlets accepted the part of the dog for the try-out too frequently. In other instances, a distributor, jobber, utility or specialty salesmen tore loose in the local market without any consideration for local conditions or the necessity for co-operation with other local sales outlets. As a consequence too frequently we have spasmodic and noncontinuous selling by individual outlets, only a few outlets focussed on the market at one time in an aggressive way, and a large majority of outlets content to rest upon business that comes to them of its own accord. The day for this type of selling has passed.

Today market development can be had most rapidly and most economically by forming some kind of a local organization of retail outlets. These must then determine their own local business plan, including:

1. How to get promotional effort and how to share the expense.
2. How to finance sales, check credit and make collections.
3. How to work out ways to purchase and to sell on fair competitive terms.
4. How and when to use organized campaigns for focussed selling.
5. How to handle installation costs, wiring additions and repair costs.
6. How to define purchasing, selling, financing and other business practices for themselves and for jobbers and national manufacturers in their market area.
7. How to modify and apply current or new national sales policies and sales programs to get maximum local results.

I do not believe these local organizations realize their power. I do not think national organizations fully realize or act upon the conception that the key to sales lies in the development of competent, organized and profitable local sales outlets.

There is no short-cut to the markets, but, on the other hand, there is nothing in the way of correcting our mechanism and our sales methods so that the markets can be sold rapidly, in volume and profitably. To get the business the industry desires attention must be focussed on organized local effort. Prices and discounts may not be correct, but they are not stopping market development and neither will changing them sell electrical products and services. We are about ready to start selling as though we meant it and to quit giving alibis.

Special training in sales

But after industry organization is perfected there is still a gap in selling, for the final action depends upon competent and enthusiastic salespeople. Successful appliance selling to homes requires sales training, sales supervision, the use of advertising and demonstration, the planning of wiring and a study of equipment location and installation. It is a highly specialized business.

At present the industry has no staff of well-trained and well-paid salespeople adequate to carry out the desired selling program. It cannot depend upon order takers. It must have salespeople who can go into each home if necessary and sell the family the appliances and services it can use or can replace. Thus to get such a staff necessitates the use of local sales schools. These should weed out the unfit and develop the fit so that trained and picked salespeople are made available. These people must become competent industry representatives and the industry must see to it that they are developed and that they are adequately paid for their work. To be successful all promotional and advertising efforts must be followed through with firing line sales. Lack of this sales staff is the greatest weakness of the industry at present. The greatest mistake made is to think that untrained salespeople, such as all utility employees or poorly paid store clerks, can do the selling required in the domestic market.

The place of the utility

Of particular importance in the local sales picture is the utility. It has been criticised justly and unjustly, but I cannot agree that its sales methods have been wrong. I believe it has done a wonderful pioneering job of merchandising at a loss. This loss was the result of defects in our whole distribution system and not the fault of the utility. Neither can I agree that the time has come for a radical change in the utility sales program. I believe the sales organizations of our major utilities have been keeping pace with the times and that they will be the first to conform to changed conditions and capitalize upon the support of utility and manufacturing executives.

From the period when the public utilities in the sales field were considered as merchandisers in the more restricted sense of the term, to the present time when the public utility merchandising endeavors and efforts are directed toward the end of revenue building, many radical changes have taken place. Now the major problem admittedly facing the industry is how to most satisfactorily and quickly rebuild the revenue. This places upon the shoulders of the sales executives in the public utility business a responsibility which will not be easily discharged, yet if diligently approached, when even partially discharged, will pay big dividends.

Each and every central station, because of its demands in the field and because of its vital interest in local building is going to be called upon to sponsor that type and

kind of program which is most productive in its particular territory. I believe that utility co-operative efforts in the past have largely come to naught, because basically underlying every co-operative move with which I have been familiar personally *has been the hidden thought of subsidy*. This, I believe, must be eliminated before a truly co-operative move of maximum benefit to all participating parties can be launched. In the future, when a sales activity is designed and launched as a co-operative measure, it should only have the necessary support to make it a self-starting venture. It should be attractive enough in itself to attach that necessary co-operation in larger or smaller degree, as may be economically satisfactory to the individual participant. It should be so designed that participation in a large or small degree will yield to the participant a dividend in direct ratio to the extent of his participation.

If this sound principle is followed and executive support is given the sales organization the utility will continue to do a good job of merchandising. And if the principles outlined are adopted by all local sales outlets there will be no internal differences in the industry because all will approach the market upon the basis of the same sales plans and a mutual understanding of responsibilities.

The general conclusion is that we must rely upon improving present methods and practices at this time, and I have suggested that this is a practicable thing to do if it is attempted in each local community. Conditions are variable, but essentially the work to do requires the making of a market study, the organization of local sales outlets, the development of practical business plans and a program for selecting and training salespeople to carry out the plan. This work involves nothing new or untried, but it is necessary. Some one to take the lead, some one to instill enthusiasm, some one to develop and institute sound business practices—these are essential. If we want the business available we can get it, but there is no short cut. We should not be content with present sales either in their volume or their profits, but to get better results we must go after the market on a better organized and more aggressive basis. The depression is past, people are going to work, they have money, they are ready for new conveniences and new services. The times are ripe for a real sales program. This is a joint job, a joint responsibility and a joint opportunity.

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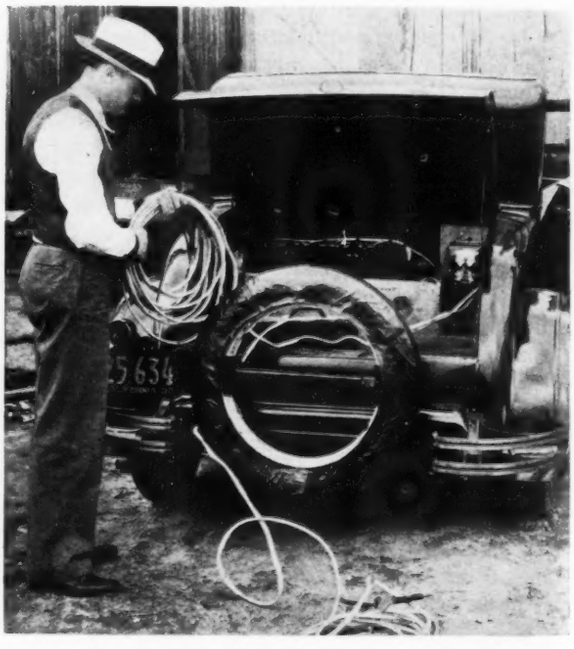
Portable Equipment Insures Oil Well Pumping Efficiency

By L. S. PETERMAN
Oil Field Power Specialist
Southern California Edison Company, Ltd.

Designed to aid oil operators in their efforts to reduce pumping costs and to operate above-ground equipment at its highest efficiency, new portable testing equipment developed by the Southern California Edison Company, Ltd., has been made available to all operators in the Edison territory. Due to the inherent characteristics of an electrical pumping unit, very positive and accurate data can be secured through the use of proper testing facilities, and experiences of the Edison company with the new apparatus in the Long Beach fields have proved its value as a means of obtaining a true index of equipment performance.

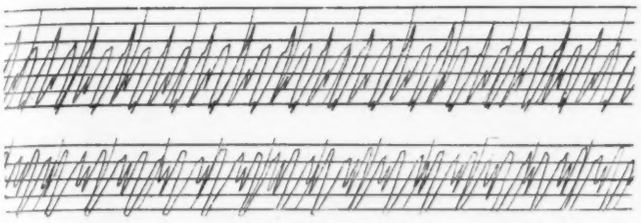
Flexibility of the testing equipment permits its use with motors of from 2 to 100 hp. capacity. It consists of a 5-amp., 110-volt, three-phase indicating and curve-drawing wattmeter mounted in the driver's compartment of a coupe, together with proper instrument transformers. Chart speeds of this instrument can be varied from 4 in. per hour to 12 in. per minute. Because curves obtained with the higher chart speeds can be more easily analyzed, the highest speed is employed. In the rear of the car two 440-220/110-volt potential transformers and two 100/5-amp. current transformers are permanently secured to the car body. Secondary instrument wiring between transformers and meter is bound together in a cable. There is also an integrating demand and watt-hour meter mounted in the back of the car, which is permanently connected in the circuit with the curve-drawing wattmeter. Through the use of switches mounted above the instrument transformers either 220-volt or 440-volt motors can be tested without disturbing any of the instrument wiring, the change from one voltage to the other being made in a few seconds.



Car equipped with oil well pump testing equipment

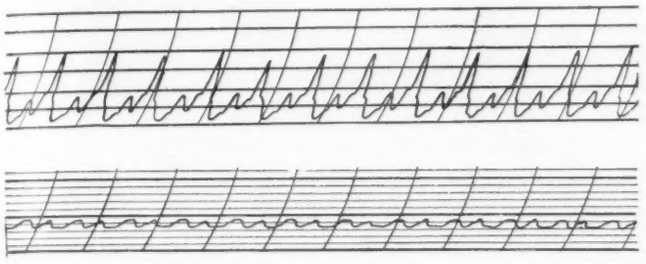
Potential and current transformers, integrating demand and watt-hour meter, cables and tools are mounted in the baggage compartment of a standard coupe; a curve-drawing watt-hour meter is installed back of the driver's seat.

Stored in the rear of the car are two 35-ft. lengths of two-conductor No. 6 flexible cable used to connect the testing equipment in the circuit of the pumping motor. One end of these cables is equipped with a plug which is inserted in the conventional testing receptacles of the consumer's disconnecting switch. The other end is permanently connected to the primaries of the instrument



Results of tests before and after reversing rotation

Upper chart shows consumption and demand with rig operating in a clockwise direction. Lower chart, taken after direction was reversed, demonstrates that peak and energy input were reduced and smoother operation obtained.



Results of tests before and after adjusting counterweight

Upper chart shows that motor was lifting too much counterweight when operating normally. Lower chart proved to operator that elimination of peak permitted use of smaller motor and that wear and tear on equipment was reduced after counterweight was adjusted.

transformers. Taped to one of the cables is a No. 18 conductor for the potential of the meters. A kit of tools, spare testing receptacles for different types and capacities of switches and stop watch complete the equipment.

In conducting a test the car is parked in a fairly level spot near the pumping rig; the cables are run into the engine house, plugs inserted in the testing receptacles and the disconnecting switch opened, by-passing the motor's energy through the testing equipment without shutting down the rig. This is necessary when testing some wells, as a shutdown of a short duration will frequently disclose altogether different load characteristics and the problem is to analyze the motor load under normal pumping conditions.

A section of chart is then run with horsepower input, number of strokes, hole in crank, direction of rotation and any other pertinent data or details noted during the test recorded. If approval has been obtained from the consumer for a test with reverse rotation, the well is shut down for three to five seconds while a change of the two plugs at the disconnecting switch is made and another section of chart is run with operating data recorded. A test can be run in approximately fifteen minutes. The accompanying charts show typical results obtained in field testing with the equipment.

Due to various factors involved, particularly when dealing with the deep wells in southern California, it is not always possible to show where actual savings can be made in every test. Tests are often made where the energy input after adjustment of the counterweight or change in direction of rotation is still the same, but in nearly every case, although the energy input is unchanged, the wear and tear on equipment and reduction of belt renewals are tangible savings to be considered by oil operators.

Metal-Arc Welding of Galvanized Steel

Neither the effect of the welding on the galvanizing nor the effect of the galvanizing on the welding is important, stated Leon C. Bibber, Navy Department, in a paper to the recent convention of the American Welding Society. The real problem in welding galvanized steel is to protect the welder from zinc fumes. Breathing zinc or zinc-oxide fumes for relatively short periods of time causes what has been called "welders' ague." But aside from this, welding galvanized steel is quite practical, as is shown by the conclusions of Mr. Bibber's paper, which follow:

(a) In plating ½ in. thick and thicker, normal welding on one side will not burn off the galvanizing on the other side.

(b) The corrosion resistance of plating from which the galvanizing has been apparently burned off by the heat of welding does not seem to have been lessened in any great degree.

(c) The zinc coating is completely burned off only along a very narrow zone at the toe of the weld; the zinc is melted at a considerable distance from the weld, but the protection of this melted zone is not impaired.

(d) Covered electrodes burn off the zinc to a greater extent and to a greater distance from the weld than do bare electrodes, but only to a small degree.

(e) Multiple bead welds burn off the zinc to a greater extent than do single bead welds, but only to a small degree.

(f) Galvanizing increases the porosity of the single bead deposits somewhat, but not to as great a degree as might be expected. The increase in porosity is negligible in multiple bead welds.

(g) Galvanizing decreases the strength of single bead deposits a small amount; the strength of multiple bead deposits seems to be little harmed.

(h) There seems to be little difference in the corrosion resistance of bare and covered-electrode welds.

(i) Small single bead fillets seem to have practically as much resistance to corrosion as the original galvanized plate. Large multiple bead welds, however, are attacked readily.

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Output in Italy Increased in 1932

Output of electric generating stations in Italy, unlike those in the United States, was slightly greater in 1932 than in 1931 and fell but little short of production in 1930. Fuel-burning plants, or thermal plants as they are called, are used chiefly to supplement the output of hydro-electric plants, for the former contain only one-sixth of the installed capacity and deliver only 3 per cent of the total energy. Lines operating at or above 120 kv. have an aggregate length of 3,390 miles. Frequencies of 50 and 42 cycles are almost equally common.

Rating of Existing Italian Installations

Data apply to plants for which reports are received by the "Unfiel" National Fascist Union of Electrical Industry; they generate about 94 per cent of the country's total energy.

Year	Water Power		Thermal Plants		Total
	No.	Kw.	No.	Kw.	Kw.
1930	912	3,421,930	240	742,436	4,164,366
1931	920	3,602,427	239	775,935	4,378,362
1932	932	3,689,446	229	796,110	4,485,556

Output (Millions of Kw.-Hr.)

	Water Power	Thermal	Imported	Total
1930	9,780	306	164	10,250
1931	9,644	263	173	10,080
1932	9,721	292	169	10,182

Rent Ranges to Increase Usage

THE real possibilities of electric cooking can only be developed through rental of ranges by utility companies. At least that is the definite conclusion of R. B. Marshall, vice-president and general manager of Electromaster, Inc., manufacturer of ranges, who just recently returned from England, where he has studied the practices and experiences of companies that have rented ranges for as long as ten years or more. Some of his observations may be helpful in developing sound rental plans for this country. He admits that some of the practices cannot be applied directly to America because of different local conditions, but he believes the experiences can be studied profitably.

Renting of electric ranges in England started more than ten years ago. Many utility companies have been renting steadily for ten years, others three to five years. Estimates from utility executives, wholesalers and manufacturers all indicated that at least 95 per cent of all ranges manufactured there reach the customer through rental by utility companies. Utilities which have been renting aggressively have reached an electric cooking saturation of 10 to 30 per cent even in territories where gas competition is keen and firmly intrenched. A good example can be found at Hull, where practically no electric ranges were in use four years ago. Since then rental has developed 7,000 users, or 24 per cent saturation of the domestic customers. Nearly every executive said he had ten times as many ranges in use as there would have been had they been for sale only.

British use low-oven ranges

Practically all ranges in England are of the "low-oven" type, because kitchens are not designed to take a wide range. Most of them have two or three surface elements, the electric teakettle being considered as an extra element. Oven is generally smaller than American ranges, but the capacity is increased by placing the elements outside the oven lining.

None of the ranges have temperature control; only a temperature indicator in the door. Practically all elements are of the solid cast-iron closed type, because the lowest voltage is 220 to 250 volts. This voltage necessitates smaller element wire, which is more subject to physical damage and oxidation failure. The slowness of preheating of these elements is the major reason for furnishing a quick-boiling electric teakettle with each range.

Most ranges are all-porcelain, with the top and sides finished in mottled gray and the front panels in white. The wholesale price of these ranges varies from $40 to $60, depending on size.

Rates and rentals

The usual rate for domestic cooking with electricity is a "two-part tariff," consisting of a demand charge, roughly equivalent to the cost of lighting, plus all energy at 1½ cents to 2 cents per kilowatt-hour. In a few cases the energy component was as low as 1 cent per kilowatt-hour.

Rental charges varied from $1.25 to $2.75 per quarter, depending on the size of range and the local policy. In some instances the rental is decreased each year as the range gets older. Most executives admitted that these rental charges were not high enough to cover all the cost of amortization, maintenance and reconditioning, but that the policy was well justified by the increased use of electric cooking that could be obtained by low rentals. They thought the U. S. policy of higher rentals very sound, especially as experience here showed real success with rentals of $1.25 to $1.50 per month.

The rental charge goes on the same bill as the energy charge, itemized separately. All billings are made quarterly. Rental is billed quarterly in advance.

Practically all range rentals are straight rentals, *without* optional purchase clause. The range always remains the property of the company and the company maintains the range in good operating condition during its life. Free maintenance applies to all operating parts, but does not cover such items as damaged porcelain enamel.

No distinction is made between home owners and tenants. Very few people in England own their own homes. However, the credit rating of the customer is carefully checked before installing a rental range. Rental ranges are in use by all income classes.

Generally only one make of range is rented by each utility. Two or three models are rented, but the only difference between these models is in size. The sizes vary from what would be called a standard full-sized range in this country down to small ovens with two surface elements. Translating this experience to conditions in the United States, where nearly every kitchen will take a standard-sized range, would mean that one model would be sufficient.

Two companies which have been renting for ten years have made it a practice to offer to replace any range that has been in continuous use for seven years.

In nearly every case the range is rented installed, the rental charge covering range, installation and maintenance. Cost of installing a range averages about $20. In some instances the work is done by the company, in

other cases it is done by contractors on an agreed average price basis.

Generally, the customer agrees to use the range at least one year. In some cases the minimum rental period is two or three years. This is not enforced if there is a reasonable cause for discontinuance, but it is considered good policy to have it in the agreement. On the other hand, several companies install the range on trial for six weeks before asking the customer to sign a rental agreement.

Most companies include a small automatic electric teakettle as a part of every range installed. This is to overcome any objection about slowness of boiling water as compared to gas.

Maintenance and replacements

When a range is removed from a home for any reason it is inspected and then either reconditioned, rebuilt or scrapped, depending on its condition. The average life before complete reconditioning is about seven years, instances varying from a few years to ten years.

Cost of reconditioning varies from $3 for fairly new ranges to $20 for rebuilding an old range. Reconditioned ranges are usually rented at a lower rental charge than new ones.

Cost of maintenance varies from $1.75 to $4.25 per range per year. This cost usually decreases as the saturation increases. Most companies stressed the point that rental ranges should be designed for low maintenance expense and low reconditioning cost.

Customers wanting to exchange old ranges for new are handled in various ways. Some companies will exchange the range on any reasonable request. Some make a charge of $5 for making an exchange. Some use the plan of decreasing rental charges as the range gets older, using this inducement to the customer to continue using the same range. Keeping the range continually in good operating condition solves a big part of this problem.

The only period when old ranges presented a serious problem was two years ago, when the all-porcelain ranges were first introduced. Ordinary minor changes in design are not considered a factor in this regard. The general opinion was that starting with all-porcelain, full-automatic ranges, as we are doing in America, there should be no serious difficulty with replacements.

Dealer relations and demonstrations

Large stores in England have never been a factor in the sale of electric ranges. Dealer-contractors formerly sold very few electric ranges, and usually objected when the central station started range rentals. However, the central stations took the attitude that ranges must be rented if the possibilities of electric cooking were to be developed. Dealers had been selling very few, and were generally not dependable when it came to servicing the ranges they had sold.

The central stations also pointed out to the dealer-contractors that with the range rental plan their wiring business would increase tremendously and their sales of small appliances would pick up as homes became more electrified. In some instances dealers were given a commission on rental customers they signed up.

Practically none of the central stations visited considered that they had a dealer problem today. The rental of ranges has come to be the accepted method.

Most central stations carry on periodic small cooking classes. A demonstrator usually calls the same day the range is installed. Some companies have a regular force of field salesmen on commission or bonus who are continually after new rental customers. Others said that most of their rental prospects developed from cooking classes or from neighbors who were satisfied users.

General attitude toward renting

It is a generally accepted opinion in England that the one way to get cooking load is by renting the equipment, because

(a) It eliminates the necessity of a large investment by the customer.

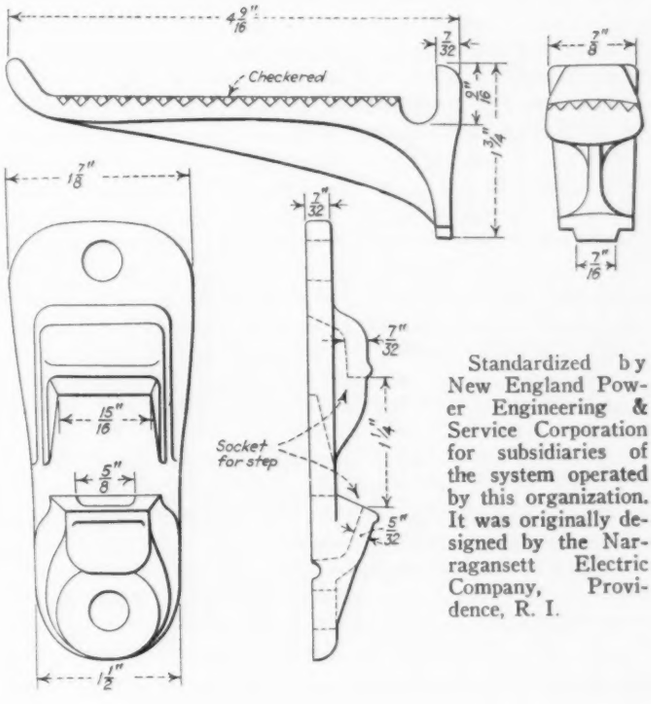
(b) It enables the customer to try electric cooking in her own home without making a long-term commitment. English utilities have the same problem we have in convincing the customer that electric cooking is reasonable in operating cost, and this is the one way to prove it.

(c) It assures the customer permanent free maintenance, which means that the range is always in good operating condition and the customer is always satisfied. Because of this several central-station executives said they preferred to rent ranges rather than sell them.

All considered, the investment in ranges for rental is a good one; in fact British utility executives figure that this investment brings bigger returns than any other investment they could make. Maintenance and reconditioning costs are considered reasonable as compared to the large increase in revenue, especially so with present ranges which have been designed for this purpose.

[The complete report of Mr. Marshall on his study of range rentals in Europe is available to any utility executive upon request by addressing Mr. Marshall at Detroit. —EDITORS.]

Detachable Pole Step and Socket



Standardized by New England Power Engineering & Service Corporation for subsidiaries of the system operated by this organization. It was originally designed by the Narragansett Electric Company, Providence, R. I.

The Inspector Looks at the Contractor

By GEO. WELMAN

Electrical Engineer,
Louisiana Rating and Fire Prevention Bureau, New Orleans

ELECTRICAL contractors in the past have been steadily engaged in wiring approximately 15,000,000 old and new buildings. But there are not enough old buildings now unwired to keep the contractors busy. Neither is there enough new construction contemplated to assure them even part-time employment in any volume. Confronted with this situation, the contractor must discover something to do by which he can maintain himself as a distinct and necessary part of the electrical industry. A natural inclination is to follow accustomed methods and endeavor to secure business in revamping old installations which in many respects need overhauling. The users, however, resent being compelled by law to make alterations and repairs and such procedure in collusion with the inspection authorities creates distrust and suspicion. Any prestige that the contractor or inspection department has built up in years of service will be destroyed through any drastic reinspection program.

The contractor must learn to sell his services if he wants his trade to continue as a distinct component in the electrical industry.

No one cares to confess that failure in business is due to a lack in himself. Absence of enthusiasm is the natural result of a depressed mind. Brains, however, are for thinking purposes, and this ill wind of the last two years does some good in putting the mind to work. It gives the contractor time to take stock, to ask himself the question, "What am I as an electrical contractor? Shall I enjoy the privileges of the past as a recognized unit in the field of applied electricity or shall I be absorbed in a reassembling of the industry? In plain words, am I actually needed as a separate entity? What have I done in my field to entitle me to recognition as an essential part? Is my mind superior in quality to that of others caught in the maelstrom of readjustment? I wired old and new buildings, I secured plans from architects and builders and my telephone was formerly busy receiving calls from owners of old buildings that were not wired. But was I not content merely to follow along the lines of least resistance and accept what was given to me?"

The inspector, being very close to the contractor, is the first to whom he applies to solve his problem. He demands that the inspector create a field for his activities. Why not apply the code to old work and have it revamped so that he may get the needed work? The contractor is restless; he knows that there must be an outlet somewhere open to him in the electrical field. The contractor of the past has been content to be the buffer in the electrical industry. He has taken a very small part, as I see it, in scientific development and research; he has neglected to be the real salesman for all branches. The contractor should be the contact man that the industry needs. He can, if he tries, sell every electrical appliance and dictate the design of wiring systems and methods of construction, but he can only do these things while being true to himself and those whom he serves. The contractor is closer to the user of electric current than any other branch of the electrical industry—central station man, manufacturer or inspector. He should be the consumer's adviser in things electrical.

The contractor's chance

Is it expecting too much of the contractor to set him the task of upbuilding the industry along moral as well as commercial lines? The contractor, as I see him in his present predicament, has only one chance of salvation, and that is to ignore entirely what anyone else may do or say and branch out for himself in a purely unselfish campaign to show the electrical world that he is capable of any trust that is placed in him. Rather a large order in these days of "the devil take the hindmost," but in a case of dire necessity he can, as a last resort, make a supreme effort. Why not, if all other methods have failed and he is on the verge of collapse anyway? The industry is crying for some one to educate the user of electric current. Will the contractor take advantage of the opportunity offered?

The safety of an electrical installation does not depend only on using a certain class of wiring material or a special class of fitting or specific gadget. A successful contractor is one who can take any standard class of material and install it in a safe manner and also give the user a high degree of efficiency. The contractor, as previously stated, is the real contact man between the user and the other branches of the industry and should be the chief exponent of safety in electrical work. But does the average contractor take even a passive interest in educating himself toward proficiency of his profession? Is he not more interested in job sheets, price lists, overhead, etc., than he is in becoming a competent installer of electrical materials and devices?

Salvation in education, not lamentation

As I see it, the contractor has a wonderful opportunity today. There are more appliances and more current used than ever before. His salvation is not in lamentation, but in education, both for himself and those whom he serves. And last, but not least, he must educate his associates in other branches of the industry so that they too will recognize him as the agency to sell electricity and the apparatus that uses it.

It is true that trade conditions are different now and that contractors are denied many of the lucrative fields of operation that they enjoyed in the past, but who is to

blame for that but the contractors themselves? Perhaps they have no Moses to lead them; perhaps they are too busy watching their own back-door steps to view the wonders of the electrical universe and to work out their own future orbits. Whatever is the cause, they admit that they have degenerated into a buffer state with all of its disadvantages. There is a pathway open; it may be a long winding road toward the land of promise, but the march should be undertaken before all avenues of escape are entirely closed by the armies of the other branches, who according to natural laws of survival of the fittest will, if the contractor declines to assume his responsibility, surely annihilate him as a separate unit.

The remedy as I see it is for the contractor unselfishly to offer his service to the industry as the contact man to create a spirit of co-operation between the users of current and all other branches of the art. I am sure that all branches will reciprocate, including the inspector. The contractor really has the advantage over other branches. He does not depend on stock valuation of his business for his profits; neither is the sale of stocks and bonds of paramount importance. His code of ethics might be extremely simple, but his business procedure must be entirely different from the past. He needs help from all branches to make a success of his salesmanship campaign, and if he has a sincerity of purpose he will be given it.

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Oscillator Kills Grain Weevils in Few Seconds

By I. E. MOUROMTSEFF
Research Laboratories
Westinghouse Electric & Manufacturing Company

A most promising industrial utilization of high-frequency fields is the salvaging and preservation of stored grain infested by the granary weevil. As early as 1927 J. H. Davis, chief engineer of electric traction of the Baltimore & Ohio Railroad, became particularly interested in the sterilization of the millions of bushels of wheat which are seasonally stored in the railroad elevators. It was at his instigation that preliminary experiments were carried out by the Westinghouse research laboratories, and further investigations with an experimental standing wave oscillator were carried on by Mr. Davis at Baltimore, Md. With this oscillator a series of experiments on the extermination of the rice weevil in wheat and other materials, using a frequency between 40 and 50 megacycles, gave useful information for the estimation of the relative economic value of this method, as compared to the others.

To destroy wheat weevils the temperature of grain in bulk must be allowed to rise to not less than 125 deg. F. Lower final temperatures, although retarding propagation, do not completely destroy the insect. Wheat grains, after having been exposed to high-frequency treatment, were found to sprout more readily and grow faster than untreated grains. The most favorable temperature for this also seems to be 125 deg. F., but even heating to 180 deg. F. does not kill entirely the germinating property of the grain. Similar effects were produced on other kinds of seeds, thus confirming the possibility of influencing growth and quality of plants, found by earlier investigators.

Generally independent of the conditions of experiments, the safe minimum of energy for 100 per cent destruction of weevils is 443 watt-seconds per cubic inch; the lowest observed limit of energy used in successful experiments of Davis was 340 watt-seconds per cubic inch. The rate of energy expenditure or power put into the grain varied between 30 and 200 watts per cubic inch with corresponding times of exposure of fourteen to three seconds.

From the figures obtained the amount of power and the cost of energy necessary for the treatment of grain in any practical case can be calculated. Thus, assuming the necessary limit of energy, 450 watt-seconds per cubic inch, $450 \times 2{,}150 = 970{,}000$ watt-seconds per bushel, or 0.27 kw.-hr. per bushel, will be needed for treatment of a bushel of wheat. This is the high-frequency energy to be dissipated in the grain. Based on 40 per cent overall efficiency of the equipment, the necessary d.c. input will be 0.67 kw.-hr. per bushel. With a specially designed oscillator and equipment the efficiency can no doubt be further increased. From this it can be concluded that the high-frequency treatment of wheat proves to be economically sound, while qualitatively the results which can be achieved are extraordinarily good.

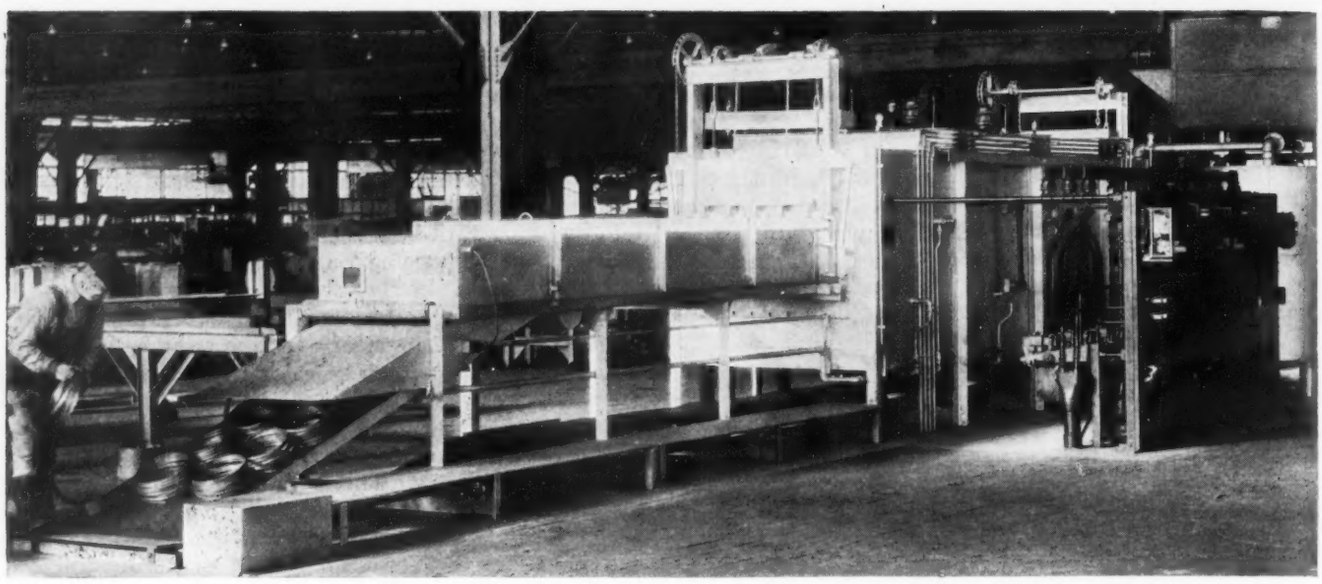
The majority of experiments recorded were made with initial temperatures of 80 to 88 deg. F., with a few carried out at 60 deg. F. Too definite a conclusion cannot be drawn as to the influence of the initial temperature. It appears that the temperature level is not of prime importance, but the amount of energy dissipated in the grain, which amount is proportional to the temperature rise, is important.

The results can be explained by the selective heating produced by high-frequency fields in animal and plant tissue. Due to the difference in conductivity and dielectric loss the insects and their eggs are evidently heated more rapidly than grain. Moreover, the insects succumb at a temperature which is not harmful to wheat. Marked carbonization of the internal tissue of weevils killed by this method appears in all cases.

The "standing wave oscillator" used is by far the most powerful generator of oscillations in the frequency band between 40,000,000 and 100,000,000 cycles per second now known. At this frequency it is capable of furnishing about 20 kw. of high-frequency power.

Personal Attention vs. Mass Selling

High-pressure and mass-selling methods are not the proper approaches today. Selective selling, introduced with good advertising and backed by intelligent effort to provide the right equipment for the exact requirements of each individual customer, is the method which will prove successful, in my opinion. Some of our utility companies for years have had a slogan, "Personal Attention to Every Customer." It is a good time to revive it and expand its application.—W. H. Hodge, vice-president Byllesby Engineering & Management Corporation, to Electrical League of Milwaukee.



Charging end of 180-kw. bright-annealing furnace

Controlled-Atmosphere Electric Furnace Bright Anneals Tubing

IN THE manufacture of copper tubing, an important product of the Cleveland plant of the Chase Brass & Copper Company, each piece of stock starts through the mill as a hollow copper cylinder. This cylinder is drawn through a graduated series of dies and plugs, reducing both the outside diameter and the wall gage to the finally required specifications. Drawing operations work-harden the metal. Consequently, at several stages ductility is found to be so decreased that the problems of further drawing operations multiply to a point where it becomes advantageous to anneal the stock to soften the metal sufficiently to facilitate further cold working. Up to the final annealing operation, this softening is accomplished by heating the copper in an ordinary fuel-fired furnace. However, in any annealing furnace which does not have atmosphere control the copper tubing emerges with a dull oxidized finish which is considered undesirable. To obtain a bright finish the oxidized copper tubing has to be pickled and finally washed to remove the acid.

To meet the mounting demand (created by the growth of the electric refrigeration industry and the revival of the brewing business) for copper tubing of first quality and appearance, yet soft enough for a final handling by manufacturers remote from the tubing plant, it has been found economically advantageous to substitute for the ordinary method of annealing and subsequent pickling and cleaning operations a controlled-atmosphere electric furnace. Such a furnace, rated at 180 kw. and installed in the Cleveland plant of the Chase Brass & Copper Company, utilizes an automatically generated and maintained artificial gas atmosphere within the heating and cooling sections of the furnace to anneal both brass and copper and preserve a bright unoxidized surface on the finished product. The heating compartment has heavily insulated walls in which are mounted the cast-grid heating elements which provide two heat zones with a range of 1,000 to 1,200 deg. F. commonly employed. The temperature of the material passing from the high-heat zone into the cooling chamber is reduced by circulating water between its double walls. Discoloration of the metal products is thus further prevented when they come out into contact with the air.

The artificial atmosphere is obtained by partially cracking natural gas, involving the mixing of illuminating gas in a closed chamber containing a controlled supply of air. The combustion of cracking is started by means of heat from electric heating elements drawing 33 kw. at the outset. The gas is introduced into the furnace through pipes cooled from a refrigerating unit sufficiently to remove by condensation any lingering water vapor in the gas. Inside the furnace the gas is kept in constant agitation by ten fans, three located at intervals in the top of the heating chamber and seven equally spaced the length of the cooling chamber top. Each fan is driven by a ½-hp., 1,120-r.p.m. motor.

The charging and discharging hoods are essentially similar, being designed to prevent the escape of heat and of the artificial gas atmosphere, while at the same time facilitating the loading and unloading of the tubing being heat-treated. Since the artificial atmosphere is lighter than air, little of it is lost through leakage while the copper is passing through the furnace, the chambers being much higher than the tops of the openings of the charging and discharging hoods. To minimize surface corrosion on the inside of the copper tubing it is, prior

to entering the annealing furnace, filled with the same gas that is used in the furnace interior. Depending upon the specifications of the manufacturer ordering it, one or both ends of the tubing are sealed as each coil is taken from the discharge end of the furnace.

A motor-driven, continuous, mesh-metal conveyor carries the material through the heating and cooling furnace sections. An adjustable-speed drive regulates the rate of passage for different types of tubing and rods, so the desired degree of anneal or softening is obtained. Copper tubing placed on the conveyor at the lower end of the charging hood comes out at the lower end of the discharging hood bright-annealed and ready for inspection, sealing, packing and shipment.

The control of the furnace is simple and largely automatic. There are two sets of control and recording instruments on the control panel, one for each heat-zone of the furnace. Five overload relays protect against accidental short circuits or grounds, four assigned to the furnace heating zone and one to the gas producer. The heating elements are protected from excessive temperatures by two strips of aluminum in the furnace heating zones and a strip of gold in the gas producer, which are so designed that they will melt at a predetermined temperature.

This heat-treating furnace was put into operation February 1, 1933. Prior to this time, the final operations on coils of copper tubing had been to fill them with illuminating gas, seal the ends, anneal in a salt pot and put them through pickling and cleaning baths. These time- and labor-consuming steps are now eliminated by the use of the bright-annealing furnace.

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Direct Current for Long-Distance Transmission

It is difficult to imagine that present-day highly developed standard alternating-current methods for long-distance transmission should ever be supplanted by a continuous current system. The relative advantages of a.c. and d.c. for long distance have always constituted an interesting question for discussion. In the early days the pros and cons were very much more evenly balanced than they have ever been since. The Thury series continuous current system was then ardently advocated by a substantial group of capable engineers. Although this system is still with us in a notable French installation which has been operating for years and which has been extended and enlarged several times, it has never been regarded, in recent years, as in any way a challenge to the a.c. constant potential system. As a consequence, in recent years the question of d.c. vs. a.c. has been discussed only in the abstract, and has been generally regarded as having academic interest only.

The question recently, however, has taken on new importance by reason of the rapid development of vacuum tube and vapor tube devices of increasing current and voltage capacities, for transforming from a.c. to d.c. and the reverse, and principally methods for their control and their adaptation to such special and obviously important purposes as the conversion from constant potential d.c. to polyphase a.c. This latter proposal has given special stimulus to the discussion, for it obviously pictures a development in which a.c. generating and distributing systems would remain undisturbed, but that the long-distance transmission line only might be converted from a.c. to d.c. The advantages of this plan in improved line regulation, stability, efficiency and insulation have been frequently pointed out. Discussion has not, however, advanced so far as to attempt a quantitative evaluation of the advantages arising in these several elements.

In a recent number of the Siemens research bulletin* A. von Timascheff presents an interesting analysis of the maximum line efficiency attainable under constant potential d.c., and compares it with the a.c. system on the basis of the use of the same conductors for each. The interesting proposal is made that for long distances the d.c. line be subdivided into sections, with intermediate substations for stepping up the voltage, with an approach to a constant potential over the whole line. The step-up device is an a.c. transformer fed from an oscillating vacuum tube circuit across the line on the low side, and with rectifying tubes in the secondary which is connected in series with the line on the high side. The net result is that each substation converts some amperes into volts, thus reducing the current with increasing distance from the generator, at the same time building up lost voltage and with a consequent greatly reduced loss, as compared with that in an uncompensated line. This type of compensated line is compared with the same line operating a.c. and compensated throughout with synchronous condensers for a corresponding maintenance of approximately constant potential.

A substantial advantage on the basis of line losses alone is immediately shown for d.c. operation. A notable enhancement of this advantage arises in the matter of voltage. Assuming that corona forming voltage is the limit in the two cases, the permissible d.c. voltage becomes $\sqrt{2}$ times the effective a.c. value. This has always been recognized as one great advantage of the d.c. system. The analysis in the paper is illustrated by several examples for distances up to 1,000 miles and voltages up to 400 kv. The advantages are naturally greater the greater the distance and the greater the amount of power transmitted.

The advantage of d.c. is not limited to the greater line efficiency, but is also reflected in the lower rating of the equipment in the compensating substations. As representative figures for intermediate conditions, the gain in line efficiency is roughly from 65 per cent for a.c. to 75 per cent for d.c. with approximate substation capacity for a.c. four times that necessary for d.c. The author points out, however, one possible limitation of these advantages, viz., the increase of cost of line insulation under d.c. Apparently the author has in mind here the question of voltage disturbances, such as lightning, and the consequent increased cost of protective measures. It may be pointed out, however, that with this particular aspect answered the life of the insulation, as, for example, in the possible use of cables, should be greatly extended under d.c. operation.

Wissenschaftliche Veröffentlichungen aus dem Siemens-Konzern, page 127.

READERS' FORUM

Aids to Examination of Meter Jewels

To the Editor of the ELECTRICAL WORLD:

The article by L. H. Kisler, entitled "Microscopic Inspection Aids Study of Meter Jewels," in the October 21 issue of the ELECTRICAL WORLD brings up a subject which in the past has caused us a great deal of inconvenience, work and expense and which we believe we have finally mastered in such a manner that it may be of interest to some of your readers.

We use a 42 × magnification binocular microscope with a specially built jig to hold jewels of various diameters and lengths. Staying within this magnification, the operator is enabled to keep the cup of the jewel in constant focus during inspection. As a source of illumination we use a 22-in. mercury-vapor lamp, mounted in a special housing which causes a reflection of the tube in the cup of the jewel. As the jewel is rotated the light beam traverses the cup and makes complete vision of the jewel very easy. Attached to the side of the microscope is a nasal atomizer aimed directly at the jewel. Although it is not by any means a perfect cleaning device, it will prove to be one of the handiest "gadgets" around a meter shop. No matter how well a jewel is cleaned, by the time it gets to the microscope there is a speck of dirt that needs removing and this atomizer will do a wonderful job on it.

We urge your readers, however, not to use carbon tetrachloride as a cleaning agent, because of its tendency to corrode the mountings of the jewel screws. This is easily proved by examining any jewel that had been cleaned a month or two before with carbon tetrachloride. We use a specially compounded cleaner which cleans almost instantly and does not leave a ring on the surface of the jewel.

The use of a needle for inspection of meter jewels is absolutely taboo in our plant. Even a moderate pressure on the cup of a meter jewel exerts a pressure of approximately two tons per square inch. Many jewels are fractured by using this method.

We have available a number of sets of prints showing the construction of our inspection device as well as the lamp assembly and stand. We will be glad to furnish these to any meter engineer interested in this phase of meter work.

HAROLD J. CUNNINGHAM,
Treasurer
Industrial Jewel Company, Inc.,
Waltham, Mass.

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BOOK REVIEWS

Rayleigh's Principle and Its Application to Engineering

By G. Temple and W. G. Bickley. Oxford University Press, 114 Fifth Avenue, New York, N. Y. 156 pages, illustrated. Price, $4.50.

This text deals with the theory and practice of the energy method for the approximate determination of critical loads and speeds. It contains examples of applications and a rigorous mathematical proof of the method. This method is applied to streets, shafts and other vibrating mechanical devices. It would be interesting to apply it to dynamic electrical systems also. The text should be very valuable to engineers and students who deal with vibrating elastic structures.

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Alternating-Current Circuit

By M. P. Weinbach. Published by the Macmillan Company, 60 Fifth Avenue, New York, N. Y. 412 pages, illustrated. Price, $4.50.

This text for electrical engineering students covers a broader ground than those usually taught. It is based upon fundamentals of circuits and is developed upon a mathematical and vectorial basis. The phenomena of radio, communication and power circuits are treated, with special applications to particular fields and individual circuit conditions.

A review is given of the fundamental laws of electrostatics and electromagnetics. This is followed by a treatment of the laws of alternating-current flow that leads to a splendid discussion of general methods of circuit solution. Resonance phenomena, coupled circuits, non-sinusoidal voltages and currents, networks, polyphase circuits, short circuit and stability phenomena, the transmission line, harmonics and transients are chapter headings that give an idea of the scope of the text. The presentation is clear and rational. The vector notation and symbols used conform to latest standards. With adequate classroom amplification of details and interpretation this is a splendid and rigorous text for electrical engineering students properly equipped with mathematics.

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Der Selektivschutz Nach Dem Widerstandsprinzip

(Selective Protection, Resistance-Controlled)

By M. Walter. Published by R. Oldenbourg, Glückstrasse 8, Munich. 172 pages, 144 illustrations. Price, 8.50 marks.

While the title refers to the resistance principle for selective protection by means of distance relays, the term is used broadly to cover also impedance and reactance controlled operations. The book is written from the viewpoint of the user of relay protection. The first quarter is introductory, explaining the principle of distance relay operation and its dependence on current, voltage and direction of energy flow. Three essential elements are considered: Actuating, time-delay and directionally selective.

The second part is more specific, with chapters, among others, on the computing of the setting for given conditions, choice of time characteristics, effects of arcing shorts, locating faults by relay indications, performance of distance relays when parallel plants swing. The author has been a frequent contributor to relay literature.

Men of the Industry

Hickernell Chief Engineer of Anaconda Wire

L. F. Hickernell, electrical engineer of the Anaconda Wire & Cable Company since 1931, has been appointed chief engineer of that organization. Prior to its disbandment, he was connected with the Allied Engineers, Inc., and its predecessors as general engineer, acting in a consulting capacity on matters of a research and technical nature involved in the design and con-

struction of electric power generating, transmission and distribution systems.

He was graduated from Grinnell College in 1920 and from the Massachusetts Institute of Technology in 1922. He entered the electrical industry during his college years, having been employed by the Iowa Light, Heat & Power Company, Grinnell, Iowa, in various capacities. Following graduation from M.I.T., he joined the graduate student engineer course conducted by the General Electric Company, subsequently serving as instructor in electrical engineering at Iowa State College. He relinquished his academic duties to enter the engineering department of the Consumers Power Company at Jackson, Mich. Mr. Hickernell served with the electrical properties at Jackson at first as assistant investigations engineer, and later as general engineer in the electrical engineering department, until the end of 1931, when he became electrical engineer for the Anaconda Wire & Cable Company, Hastings-on-Hudson, N. Y. As chief engineer of that organization he will be in charge of the engineering department and all laboratories.

Mr. Hickernell has been active on the engineering committees of the American Institute of Electrical Engineers, the old National Electric Light Association and similar organizations and is the author of numerous reports and papers presented to these associations. Other activities include memberships on the committees of the American Society for Testing Materials, the National Electrical Manufacturers Association, the Insulated Power Cable Engineers Association and the National Research Council.

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FRED S. HUNTING has returned from his retirement from business in California to accept the presidency of the Fort Wayne National Bank. Mr. Hunting lived in Fort Wayne from 1888 to 1922, much of the time in charge of the General Electric plant, and later was president of the Robbins & Myers Company at Springfield, Ohio. He retired from active business in 1927. His many friends in the electrical industry will be glad to learn of his return to active work in his new and important position.

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MORRIS L. COOKE of Philadelphia was appointed last week chairman of the Mississippi Valley Committee of the Public Works Administration, which will correlate work in the Mississippi Valley and its tributaries, including flood control, power, navigation, reforestation and soil erosion projects. Mr. Cooke is consulting engineer with offices in Philadelphia, where he was director of the Department of Public Works from 1911 to 1915.

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A. G. NABORS, formerly manager of the utilities department, Graybar Electric Company in Chicago, has resigned to become sales manager of the National Pole and Treating Company, producers and processors of Northern white and Western red cedar poles. He entered upon his new duties November 1 in the newly opened sales office of the company in Chicago. Mr. Nabors has long been identified with the sale, purchase and use of poles and is widely known in the field. He became associated with the Bell Telephone interests in 1901 and has been successively connected up to the present with the American Telephone & Telegraph, Western Electric and Graybar companies.

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JOHN F. HOGAN has been elected president of the Tucker Electrical Construction Company, New York, to succeed James R. Strong, resigned. Mr. Strong had been president of the Tucker company since 1890. In the course of his career he did much to advance the interests of the electrical contractor-dealer through association work. He was a charter member of the National Association of Electrical Contractors and it was to him that the association owed its constitution and the molding of its plans to meet the changing times. Mr. Strong served as president of the association for several terms.

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JOHN S. AMES has been elected a member of the board of directors of the Edison Electric Illuminating Company of Boston to fill the vacancy caused by the death of Rodolphe L. Agassiz.

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OBITUARY

Edward N. Hurley

Edward N. Hurley, manufacturer and financier, died November 14 in Chicago in his seventieth year. Mr. Hurley, who was wartime chairman of the United States Shipping Board, had devoted recent years to civic interests, and at the time of his death was prominent in political circles and industrial affairs in Chicago, the State of Illinois and the nation. In 1907 he organized the Hurley Machine Company, now known as the Electric Household Utilities Corporation, one of the largest manufacturers of electrical equipment for the home, and at the time of his death was serving as chairman of the board of the Middle West Utilities Company, in that company. He was co-receiver of whose interest he spent several weeks in England on matters affecting British investors in the Insull enterprises. A prominent figure during the World War, he received the distinguished service medal of his own country for the eminent services he performed.

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Arthur E. Childs

Arthur E. Childs, president of the Massachusetts Lighting Companies, member of the executive board of the New England Power Association and a director in numerous gas and electric utilities in eastern New England, died at his home in Boston November 9 after a protracted illness. Mr. Childs was a native of Montreal and was educated at McGill University in that city and at Central College, South Kensington, England. He entered the electrical industry through a connection with the Canadian General Electric Company and was later associated with the late Dr. Coleman Sellers in the development of hydro-electric power at Niagara Falls. Following this he served for three years as district engineer of the Westinghouse Electric & Manufacturing Company with headquarters at Philadelphia. He then became New England manager for the Electric Storage Battery Company at Boston. In 1907 he organized the

Light, Heat & Power Corporation at Boston to acquire various scattered gas and electric utilities in Massachusetts, and these were later grouped under the Massachusetts Lighting Companies, including properties serving small and medium-sized municipalities from North Adams, Northampton, Palmer and Clinton eastward to Arlington, Franklin and Wareham. His directorships included the International Hydro-Electric System and the New England Power Engineering & Service Corporation, and he was president of the Columbian National Insurance Company of Boston at the time of his death.

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Edwin A. Davis

Edwin A. Davis, formerly vice-president and controller of the Middle West Utilities Company, committed suicide November 7 at his home in Los Angeles, where he had been living for the past three months. Mr. Davis had spent many active years in the public utility industry. A Canadian by birth, he entered the utility field in New England with the Stone & Webster interests. After connections with the Stone & Webster properties at Fall River, Baton Rouge and Woonsocket, he left the utility industry to acquire accounting experience in other lines of business. He returned to public utility accounting in 1916 with the subsidiary companies of the Middle West Utilities Company in Oklahoma. He went to Chicago in 1920. For many years Mr. Davis was active in the Accounting National Section of the National Electric Light Association, serving as chairman for the 1927-1928 period. He was 52 years of age.

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E. J. PIETZCKER, formerly Southwestern manager for the Standard Underground Cable Company, died October 18, of a heart attack, at his home in St. Louis. Mr. Pietzcker became manager for the cable company in 1902. He retired several years ago when the company was merged with the General Cable Company. Mr. Pietzcker was 75 years of age.

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RICHARD R. BOWKER, author, publisher and industrialist, died November 12 at his summer home near Stockbridge, Mass., in his eighty-sixth year. Mr. Bowker was appointed in 1890 first vice-president of the Edison Electric Illuminating Company of New York, a position he occupied until 1899. In this capacity he made the acquaintance of Thomas A. Edison and gained his confidence and friendship. He was a vice-president of the Edison Pioneers. Mr. Bowker was vice-president of the De Laval Turbine Company and the De Laval Separator Company from 1901 to 1931.

New Equipment Available

Shock-Proof Lamp Guards

Portable lamp guards made entirely of insulating materials are announced by the D. C. Wilson Company, New York. The fiber guard is made of processed vulcanized fiber secured with small, but strong, brass eyelets which cannot either short circuit contacts or shock users. The rubber handle is made of high-grade compound, stiff enough for ease in handling but flexible enough to afford considerable protection to lamps against breakage. The guard is secured to a groove in the handle by a rubber ring slipped over the lower part of the guard.

A fiber disk in the handle takes the strain of the wires off the socket contacts. The wires are connected directly to contacts on the base of the porcelain socket in the handle. No splicing, soldering or taping is required.

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INDICATING LAMPS for application where good visible indication, with long lamp-life and low-wattage consumption, is required have been announced by the General Electric Company. They can be used for signal-light indication or, in combination with control switches, to tell whether a circuit breaker is open, closed or tripped automatically.

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SIMPLIFIED LADDER AND MOUNTING known as the Keystone ladder mount has been placed on the market by Electric Service Supplies Company, Philadelphia, Pa. It is an invention of Thomas Hooker of the Delaware Power & Light Company and consists of an extension ladder mounted on a tubular base, the ladder proper being rotatable and vertically adjustable to several positions. The complete ladder and mounting base assembly is designed for bolting directly to the bed of a truck body. The arrangement of this device is such that it can be operated very successfully by a single operator who will drive the truck and do the servicing work.

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Three Different Wattages from One Lamp

To meet the need for greater flexibility of illumination from lighting installations the Westinghouse Lamp Company, Bloomfield, N. J., has introduced a twin-filament lamp in two sizes, known as the "Three-Light" lamp, which will produce three different wattages.

The Mazda 150-200-watt lamp in a PS-35 bulb will consume 150, 200 or 350 watts; the 200-300-watt lamp in a PS-40 bulb will consume 200, 300 or 500 watts. Both lamps are designed with inside-frost bulb and will operate on either 110, 115 or 120 volt circuits. The "Three-Light" lamp is constructed with a mogul screw base which has two bottom contacts; one contact is an eyelet, somewhat smaller in diameter than that in the present mogul screw base; the other is a ring or washer which surrounds the eyelet.

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Carbon Dioxide System Battery

A new method of mounting cylinders in a carbon dioxide fire protection system known as the "Inverted Alfite System" has been announced by the American-LaFrance and Foamite Corporation, Elmira, N. Y. Instead of being placed upright, as usual, the cylinders are mounted valve downward on trunnions and are operated by the force of gravity. When the battery is operated each cylinder drops a short distance, banging down with the full force of its 160 pounds plus impact on the cutter knob, thus piercing the gas-sealing disk.

Due to the method of support and the fact that the connectors between the cylinder and manifold are flexible, each cylinder can be weighed in place by the "Alfite" weighing device without disconnecting or removing it from the battery, thus making periodic inspection easy.

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A NEW FLUSH TYPE FERRULE which eliminates many of the faults of the ordinary ferrule, has the same effective length and enters the tube sheet the same distance or number of threads as the standard condenser ferrule has been announced by the Scoville Manufacturing Company, Waterbury, Conn.